

COMMUNICATIONS

OK

**AIRLINE RADIO
MAINTENANCE**

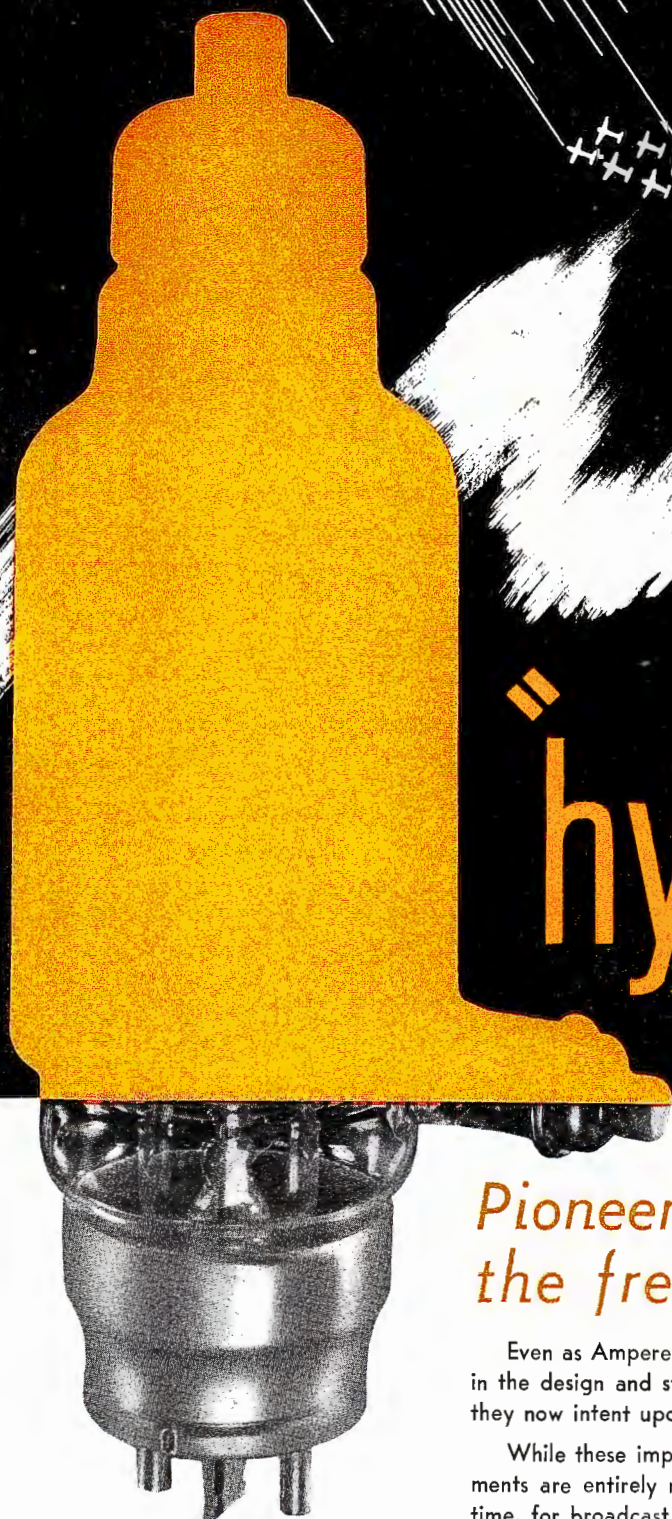
**REVIEW OF 20th ANNUAL
NAB CONVENTION**

**WARTIME MAINTENANCE
OF CONTROL EQUIPMENT**

**100-CYCLE
FREQUENCY STANDARD**

**MAY
1942**





“hyper-highs”

*Pioneering in development of
the frequencies of the future*

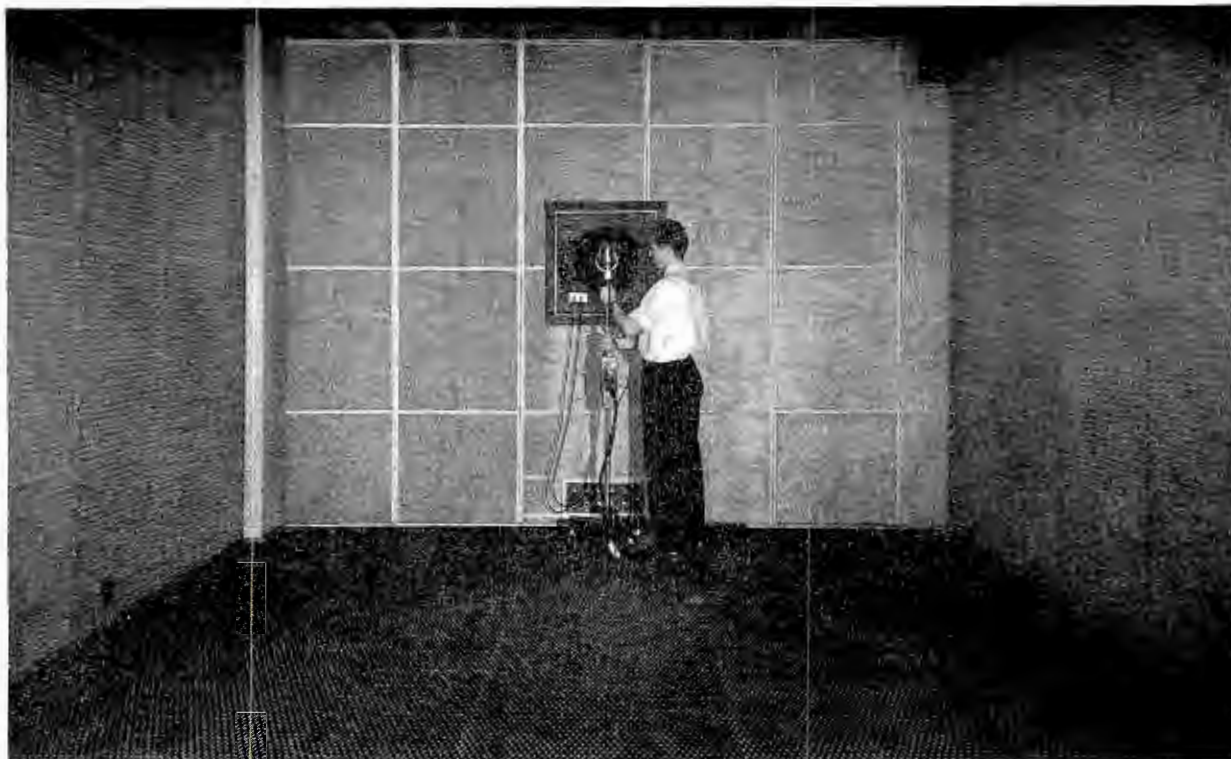
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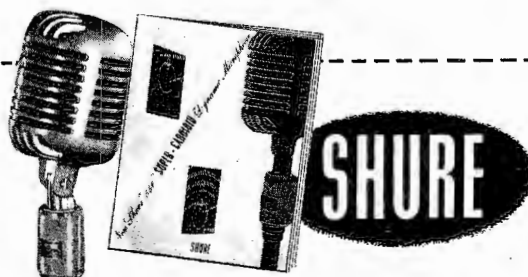
In addition to close tolerances in output and response, Shure Microphones must survive electrical and mechanical tests which are far more destructive than any conditions they meet in actual service.

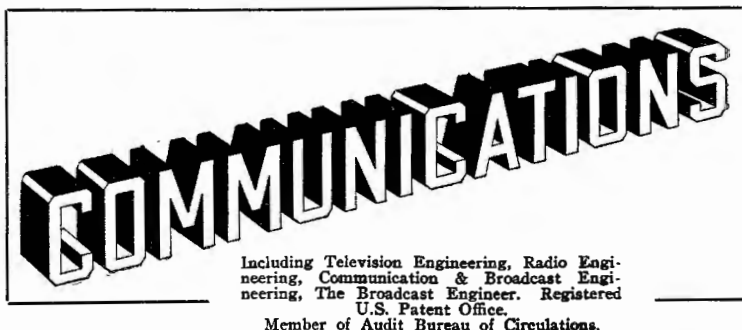
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We See...

MAINTENANCE HAS BECOME THE formidable power in the communications world today. With the profusion of rulings, edicts and recommendations pouring out of Washington, prompting curtailments in a variety of patterns, it has become more and more evident that effective maintenance will be truly the "answer to the prayer." For only with a well planned maintenance program will operations of systems, large and small, be able to keep pace with current demands. To propel such programs, many have instituted maintenance campaigns. Featured in one such campaign in another industry is standardization of practice, a procedure that has untold application possibilities in communications, too. There are, no doubt, many types of equipment of special design to which ordinary or standardized methods of maintenance could not be applied. But, contrariwise, there is an abundance of equipment in plants, to which standards of practice could easily be applied, as for instance, electric controls, a discussion of which appears in this issue (pages 10, 11, 12 and 27). There are other similar types of equipment which could easily benefit from a simplified and standardized method of maintenance. An inventory of your facilities will equip you with the correct pattern to follow for effective maintenance. Start your program now!

WARTIME CONDITIONS SEEM to have the faculty of exacting rulings, always deemed essential, yet never authorized. We refer to the newest FCC ruling requiring registry of diathermy devices. There'll be no legal "illegal" transmissions, now, we hope!—L. W.

MAY, 1942

VOLUME 22 NUMBER 5

COVER ILLUSTRATION

Communications to the rescue. While Ralph Hadfield (in fur coat), member of the Mount Hood Ski Patrol, stands by, Forest Ranger Albert Weisendanger, arranges for first aid help to injured skiers some miles away.

(Photo by G. Henderson, Courtesy Forest Service)

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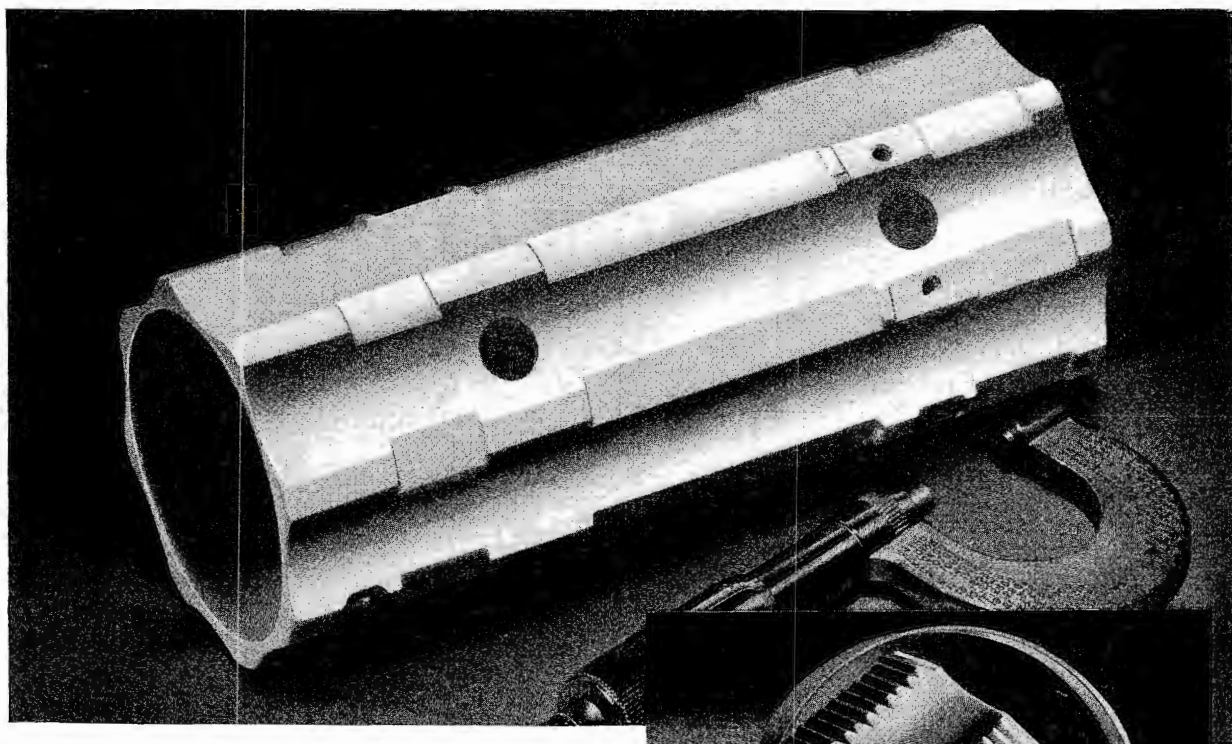
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AIRLINE RADIO MAINTENANCE

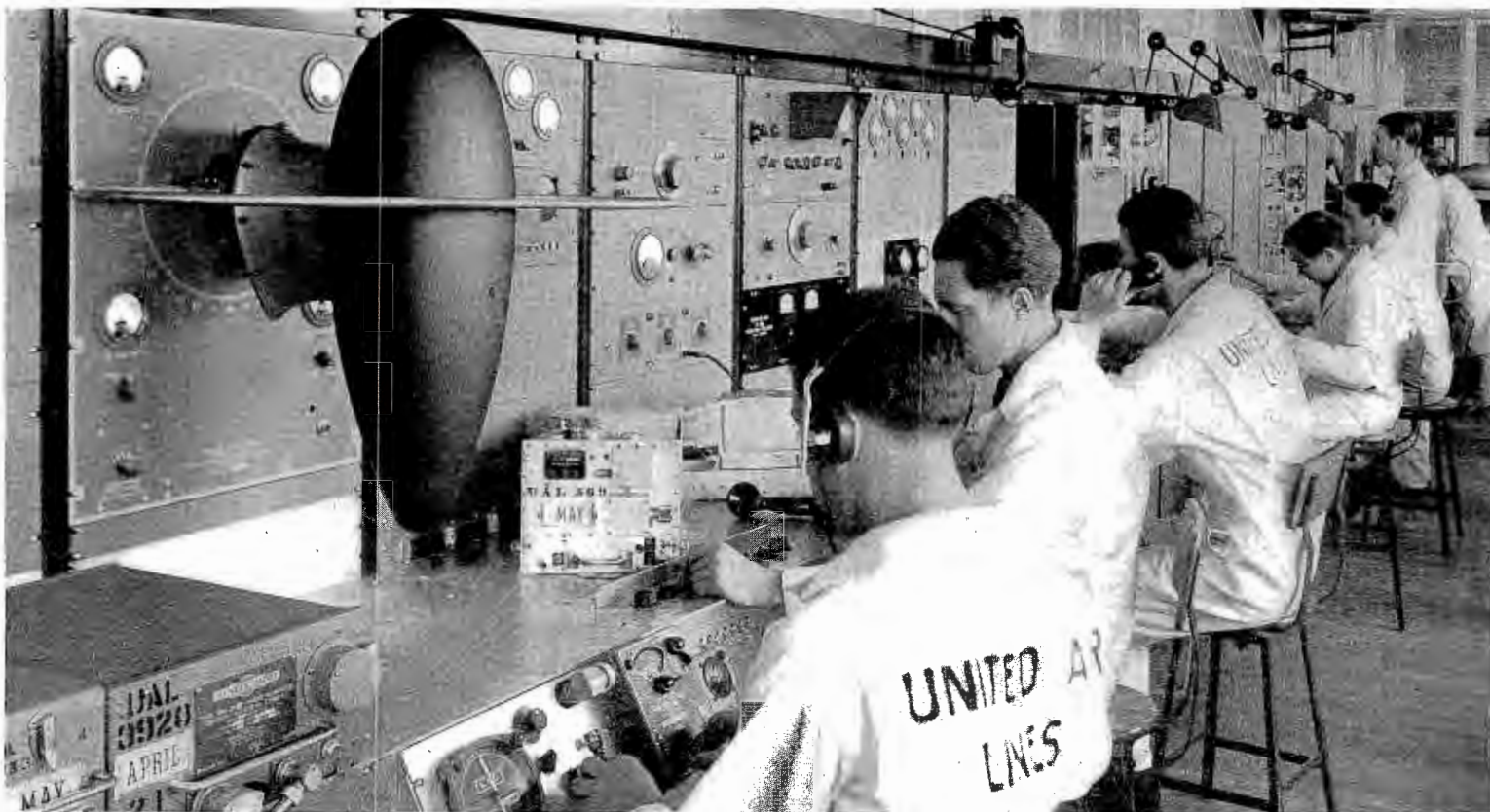


Figure 1

THE radio equipment used in commercial transport aircraft is the road, the road map and the sign post for the flyer. Therefore, it is important that it be operating at peak performance at all times. With a properly designed airplane, the pilot can circle an airport and demonstrate the airplane's speed, load carrying capacity, etc., but without radio he cannot hope to navigate between terminals day in and day out. It is important, therefore, that the radio equipment not only be well designed but that it be tested at intervals in order to determine possible weaknesses.

The methods and facilities of United Air Lines, a pioneer in the field of aircraft radio, may be reviewed as repre-

sentative of what is being done in airline radio maintenance.

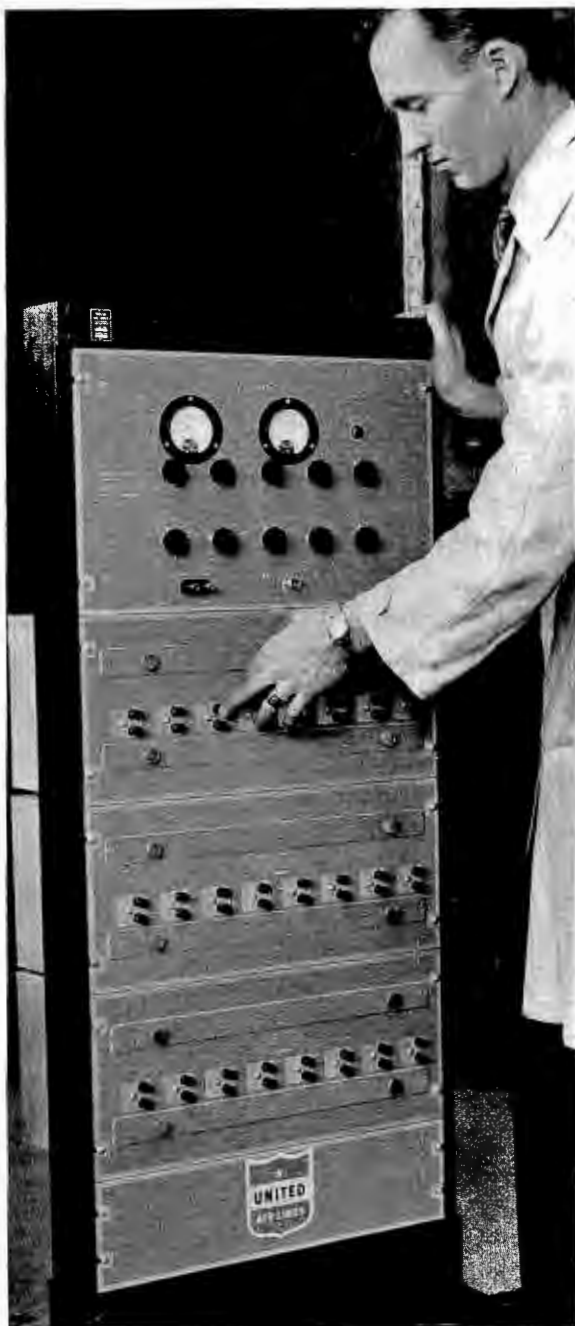
When a pilot has completed a trip he makes notations in the log book, mentioning even the slightest irregularity that he has observed while operating the radio. These irregularities may range from noise and burned out dial lights to the infrequent major failures. A radio mechanic reads these reports and proceeds to make corrections. Incidentally, a copy of all of these radio irregularity reports are sent to the Communications Laboratory so that engineers there know each day the nature of the difficulties which are being experienced in using

by **P. C. SANDRETTO**

Superintendent Communications Laboratory, United Air Lines

radio equipment in the field. In addition to making corrections, mechanics check the radio before a trip is about to depart, no airplane leaving until each item of its radio system is in perfect working order.

The radio mechanic referred to belongs to one of several radio shops which the airline maintains for the purpose of making necessary corrections in radio equipment when reported. In addition to these shops the airline maintains a large shop in which radio equipment is serviced at regular intervals without regard to failure reports. These intervals usually coincide with the time



of 5 kw) from interfering with the measurements that are being made on the receiver.

Large Repair Shop

A large shop is shown in Figure 1. In this illustration is shown a group of men, each an expert in some particular field, operating test equipment designed to do one certain job. One man is an expert in maintaining radio direction finders, another in maintaining radio range receivers, another in maintaining transmitters, etc. While it has been possible to buy certain equipment, such as audio oscillators and cathode ray oscillographs on the open market, much special equipment has been required to permit efficient servicing of the radio units.

One of the special units that has been designed is shown in Figure 2. This is a crystal-controlled signal generator. The airlines use radio equipment operating on fixed frequencies as much as possible. There is, therefore, no tuning adjustment provided when the airplane is in flight and it is necessary that the receivers be aligned to the correct frequency in the shop. Some of this equipment operates on a number of fixed frequencies. The combination radio receiver and transmitter shown in Figure 3, for example, operates on 10 frequencies. In addition to the necessity for aligning this piece of equipment on 10 frequencies, it also is necessary to align the intermediate stages on four frequencies because of their band pass characteristic.

The Signal Generator

The signal generator shown in Figure 2 is designed to provide as many as

Figures 2 and 3.

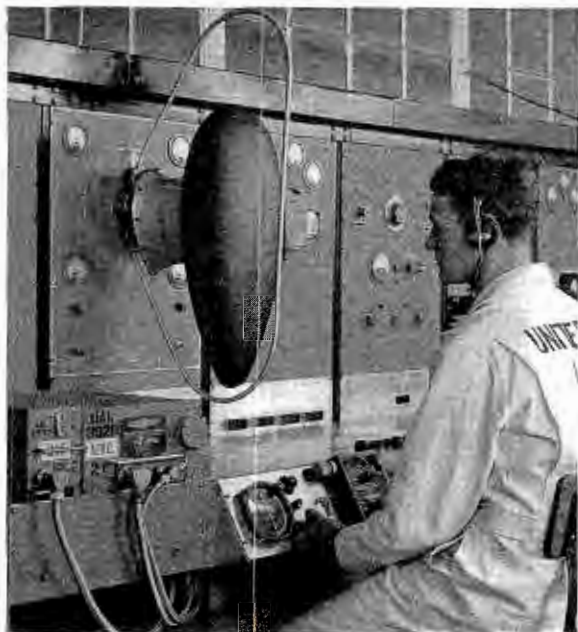
In Figure 2 (left) we have the signal generator developed by United Air Lines for aligning receivers and checking transmitter frequencies. In Figure 3 (upper right) appears one of the fixed frequency combination transmitter-receivers, which must be aligned at regular intervals in airline service shops.

when airplane engines are overhauled. It is the duty of this major radio overhaul shop to examine each piece of equipment to make sure that it is in proper working order and to detect, if possible, those weaknesses which might cause a failure to occur. In addition, this shop has the responsibility for making improvements in radio equipment in order to keep it consistent with latest progress in the communications art.

Even the largest airlines do not maintain more than five radio shops and of these, usually only one is fully equipped. Therefore, the manufacture of the special test equipment required is not at-

tractive to the commercial manufacturer and it has been necessary for the radio engineering staffs of the airlines to design their own test equipment.

Each airline radio shop has one or more screen rooms. These are utilized for tests of receivers and transmitters. The necessity for testing transmitters in a screen room may seem rather odd; however, this is necessary in order to prevent radiation from the transmitter interfering with the local airline communications stations. A screen room for testing receivers is, of course, necessary in order to prevent the local communications stations (which may have a power



40 frequencies. It consists of three parts. The first part is an oscillator unit. In this unit there is a push-pull crystal oscillator arranged with harmonic suppression circuits so that only the desired frequency is generated. This complete oscillator unit plugs into the back of an oscillator panel which is arranged to hold a total of eight oscillators. It is one of the three similar panels shown in Figure 2. The desired oscillator may be selected by pushing a button. When this button is pressed the oscillator is placed in operation and its output is then amplified by the third element of the signal generator, an amplifier unit. This amplifier unit is equipped with the necessary attenuators and will deliver from $\frac{1}{4}$ microvolt to 1 volt of radio frequency. It is modulated at any one of six different frequencies from an internal oscillator with a modulation percentage of up to 100. In addition, an external oscillator may be connected in order to modulate at other frequencies for obtaining audio response curves. This signal generator may also be used as a frequency measuring device to check the frequency of transmitters. When the "off" button of the oscillator is pressed the frequency of the crystal is lowered so that the mechanic may know whether the beat note which he has observed between the signal generator and the transmitter corresponds to a frequency difference above or below the desired frequency. For purposes of aligning the crystal oscillator exactly on frequency a small condenser is connected across the crystal.

If the operator turns on two oscillators a light flashes on the amplifier panel indicating to the mechanic that he has made his second frequency selec-

tion without first turning off his previous choice. As the demand for frequencies grows it is possible to continue to add oscillator panels and at least 40 frequencies can be provided, although only 24 are shown in Fig. 2.

Automatic Direction Finder

An example of an unusual type of test equipment is shown in Figure 4. This is a unit for testing automatic direction finders. With an automatic direction finder a pilot tunes in a station and a needle on the indicator immediately points to that station. Because of

the effect of the airplane on the direction finder, it is necessary to provide a correction mechanism in the form of a cam which automatically changes the bearing so that the indication on the face of the automatic direction finder is correct. It is necessary to check the operation of the radio direction finder at all angles in order to determine that it is giving correct indication for every bearing. The egg-shaped device shown in Figure 4 houses a loop antenna. This loop antenna is removed from the airplane at overhaul periods and slips into a fitting at the center of the test panel. Around

(Continued on page 26)



Figures 4 and 5.

Figure 4 (upper left) illustrates a device designed by United Air Lines for testing automatic radio direction finders. In Figure 5 (right), appears the vibration machine used to locate noise in aircraft radio receivers. Note the air-operated generating unit below that actuates the test table to which the radio set is attached.

A 100-CYCLE FREQUENCY STANDARD

by P. M. HONNELL and L. W. DICKERSON

Southern Methodist University

Texas Development Corporation

TIMING-FORK controlled oscillators are utilized in numerous types of geophysical apparatus to provide precise measurements of time-intervals. In seismic prospecting, for instance, such oscillators are used to drive auxiliary oscillograph elements which trace timing lines on the same oscillographic record on which the seismic data are recorded.¹ In order that a reliable interpretation of computed depths and dips of geological strata may be made from such seismic records a relatively high order of accuracy is required in the measurements. This applies particularly to the timing-fork oscillators which must have very stable driving circuits² and an exactly calibrated oscillating frequency. Furthermore, the frequency calibration must be checked periodically to discover small drifts such as may be caused by aging of tubes, changes in the spacing of driving coils on the tuning fork, and the like.

Calibrating Many Oscillators

When relatively large numbers of these timing oscillators must be calibrated and periodically checked, a primary frequency standard furnishing exact frequencies of the required order of accuracy, and precise means of comparing the oscillator outputs with the frequency standard output by the method of beats, becomes the most practical method of making the calibrations. The purpose of this article is to describe briefly a 100 cycle per second primary frequency standard used as the standard of comparison for this type of measurement.

100 Cycle Tuning Fork

The choice of a 100 cycle tuning fork for control of the fundamental oscillator of the frequency standard was dictated by the fact that this was the frequency of the timing oscillators to be calibrated. This materially simplified all the circuits since no frequency-dividing is then necessary to obtain a standard frequency which can be compared (beat) directly with the timing oscillators' out-

put frequency. The use of a quartz-crystal controlled oscillator of a low radio-frequency as a standard oscillator, would have entailed considerably more complex equipment to obtain the necessary division of the crystal frequency, as required for the measurement of 100 cycles per second, or the first few harmonics thereof.

Frequency Standard Assembly

The complete standard frequency assembly, as shown in Figure 1, comprises a precision fork, vacuum-tube driven, mounted in a double temperature controlled enclosure, which drives a synchronous 100 cycle clock through suitable clock amplifiers. A time signal receiver facilitates the accurate checking of the standard assembly against Naval Observatory time signals from

which the exact frequency of the standard can be computed. A voltage regulator, power supplies, and a standard frequency output panel completes the assembly.

The Voltage Problem

A simplified schematic diagram of the circuits involved in the equipment is shown in Figure 2.

It was found early during the development of the frequency standard that the available commercial power supply voltage was not sufficiently stable to ensure successful operation, since one or two line voltage surges during a 24-hour period seriously invalidated the standard clock reading, making measurements to the desired order of accuracy impossible. Due to variations in industrial loading, during the day-time,

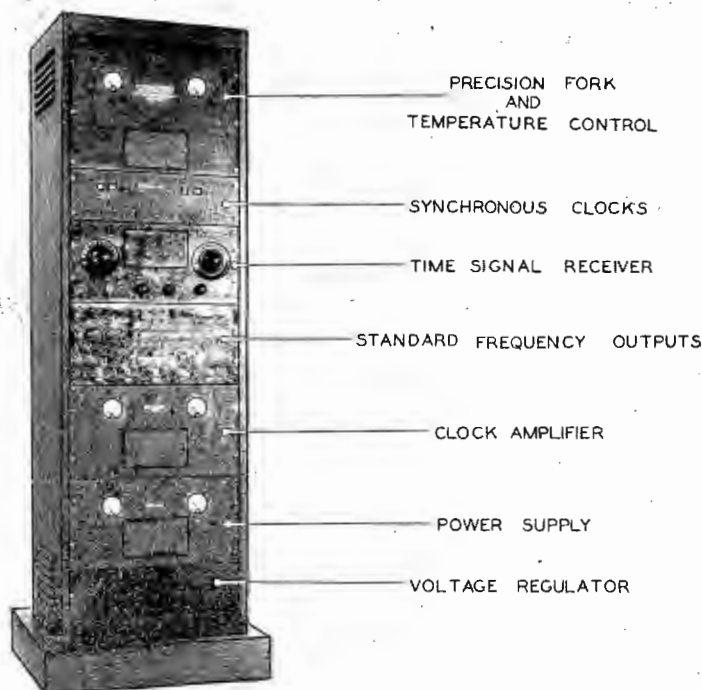


Figure 1

The 100 cycle per second standard frequency assembly.

¹P. M. Honnell, "Communications in Seismic Prospecting," *Communications*, December, 1940.

²P. M. Honnell, "Record counter aids in seismograph computations," *Oil and Gas Journal*, January 18, 1940.

and residential lighting load, during the night-time, these surges are almost always present during 24 hours. Thus, as shown in Figure 2, a main voltage regulator of the partial resonance type was employed to stabilize against large, slow, power line voltage variations. An auxiliary voltage regulator of the gas-tube type was also added to maintain constant the plate and screen supply voltages of the 100 cycle oscillator; this also helps to reduce the effects of sharp surges in the line voltage which would otherwise be amplified and adversely affect the clock readings. The auxiliary power supply also supplies the plate and screen voltages to the buffer amplifier, thereby decreasing reactions on the standard oscillator.

The standard oscillator of the assembly consists of a 100 cycle per second General Radio type 815-A precision fork, converted to vacuum-tube drive and employing a degenerative oscillator circuit³ of high frequency stability and excellent waveform. Degeneration, in-

³P. M. Honnell, "Note on Feed-Back Oscillators," *Review of Scientific Instruments*; August, 1938.

troduced by the cathode resistor R_1 , stabilizes the vacuum-tube driving circuit against gain and phase variations, reduces harmonic content, and maintains the desired amplitude of oscillation of the tuning-fork tines. The resistor R_1 is adjusted for the threshold of oscillation, which is generally the best operating condition.

Buffer Amplifier as Driver

The output of an isolating or buffer amplifier drives three separate channels from which the standard frequency is utilized. The first channel consists of a power amplifier which drives the 100-cycle synchronous clock which integrates or counts the number of cycles of operation of the standard fork in 24 hours. (A 60-cycle synchronous clock is provided as an aid in lining up the standard.) The clocks are self-starting; by means of the switch S the standard clock may be started such that the seconds dial is within one second of Naval time signals. A mechanical adjustment shifts the zero setting pointer and this allows the clock to be lined up

to within a fraction of a second with the beginnings of the second dashes of the time signals (the ends of the dashes are without significance). Checks of the clock rate every few hours, or 24 hours, against time signals then gives an immediate and continual check on the frequency standard.

Second Amplifier Channel

The second channel is an amplifier furnishing 100 cycles per second standard frequency output, through a power amplifier, for measurement purposes.

The third channel feeds a harmonic generator which provides harmonics of 100 cycles for measurement purposes. From the harmonic generator, a control voltage is also obtained which is used to lock a multivibrator to exactly 1000 cycles per second fundamental oscillation component. The potentiometer R_2 is adjusted to inject the proper amount of control voltage to lock the multivibrator.

The output of multivibrator furnishes harmonics of 1000 cycles for measurement
(Continued on page 35)

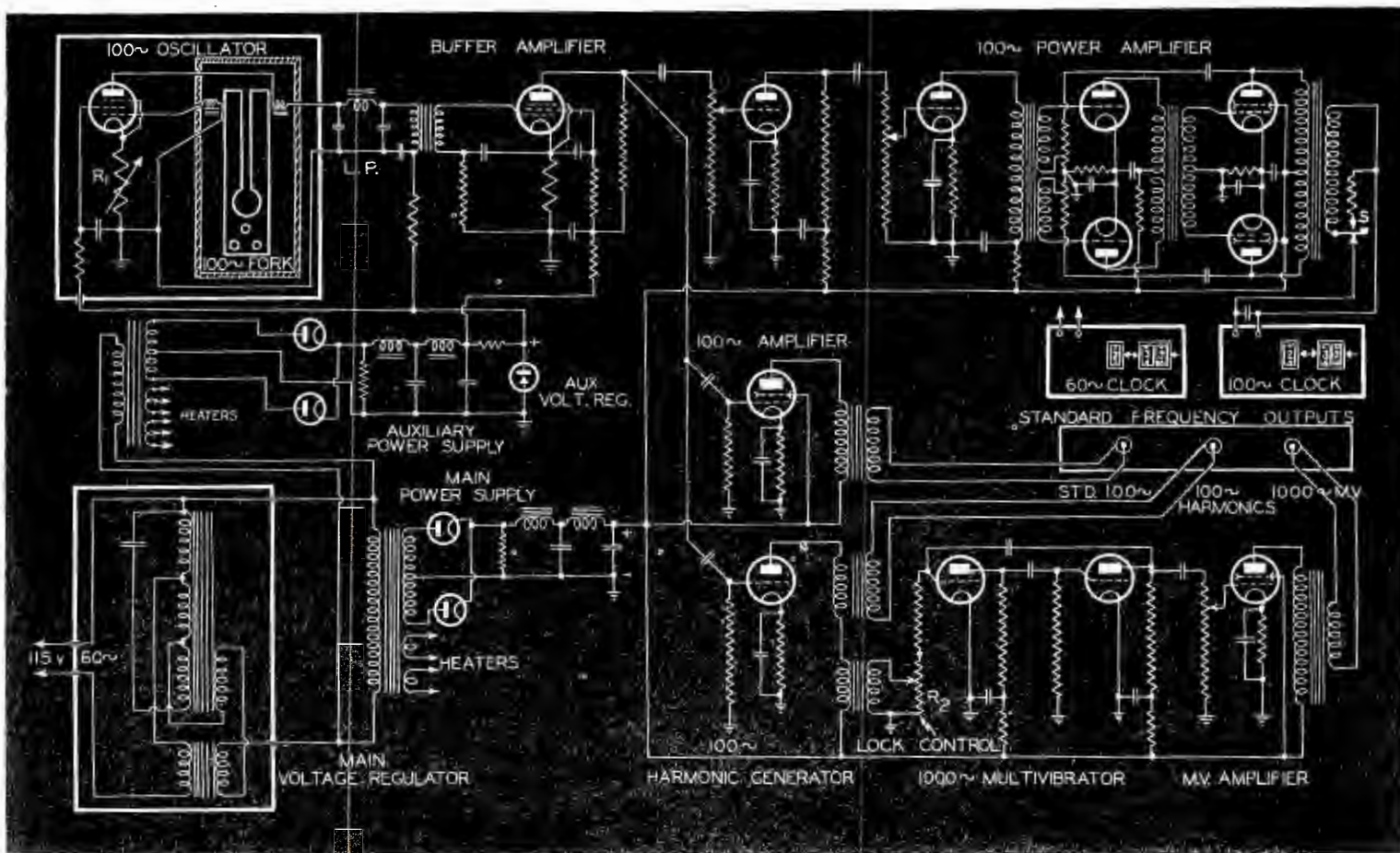


Figure 2
Schematic of principal circuits of the 100-cycle per second standard frequency assembly.

MAINTAINING CONTROL EQUIPMENT

A Thorough Study of Power Unit Maintenance Based on War-time Demands

by E. H. ALEXANDER

Engineer, Industrial Control Division,
General Electric Company

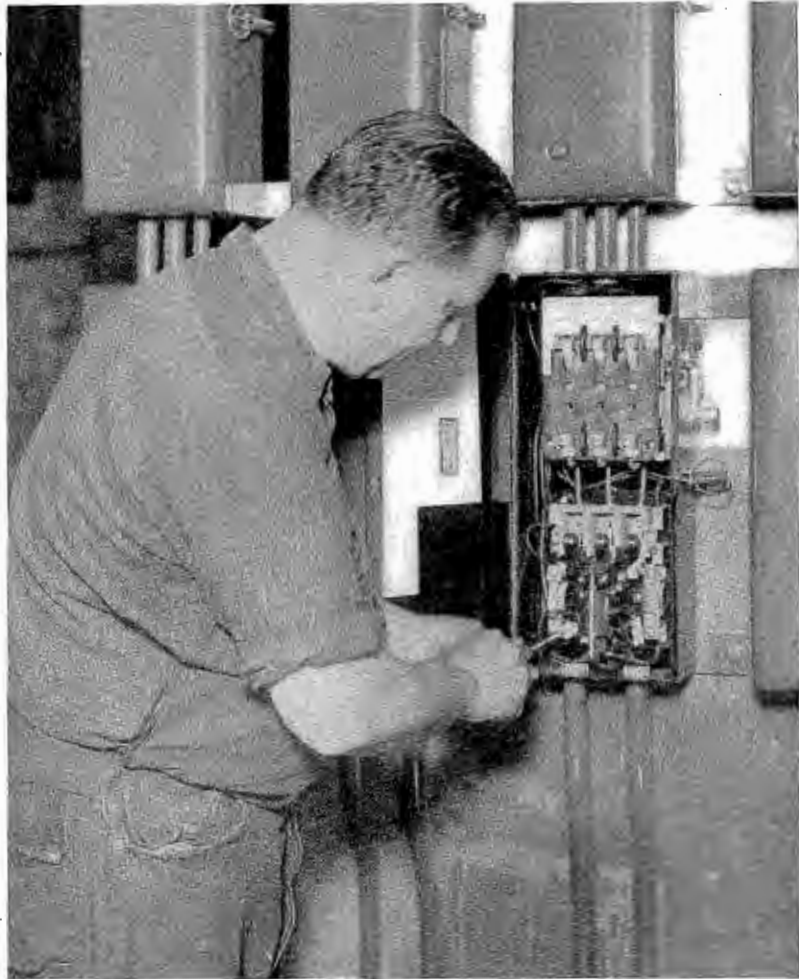
ANY equipment in daily use, and upon which industry depends for continuity of service, requires periodic inspection and maintenance. This is especially important today with peak capacity and performance more essential than ever before.

Electric control is no exception to this rule. After operating sometimes thousands of times a day, it is vitally important that controls be inspected regularly and that replacements or repairs be made quickly when necessary.

As in all operating equipment, prerequisites to any good maintenance program are the proper selection and installation of the equipment.

In the selection, for instance, it is not only necessary to consider the ordinary conditions that will require various types of servicing, but the unusual in conditions, too, that will demand special types of servicing. Unusual conditions may include operation in damp places; exposure to damaging fumes, excessive dust, gritty or abrasive dust, steam, excessive oil vapor, salt air, vibration, shock, tilting, explosive dust or gases, and weather or dripping water.

In installation and adjustment, the other important prerequisites, we have such factors to consider as control panel mounting. The panel, for instance, must be mounted vertically, so that the contactors will open by gravity when the power is cut off. Panels should be mounted on a flat surface, and care should be taken not to twist the back when mounting. Copper grounding ter-



Panels should be mounted vertically so that contactors will open by gravity when power is cut off.

minals are provided on open controllers for connecting ground wires to the apparatus. The conduit connection to the cases of enclosed controllers is considered sufficient grounding protection.

The sealing surface of the magnet frame and armature is spread with grease or oil to prevent rusting in shipment. Thus the grease or oil should be removed when the contactor is put into service, but the surface should be wiped occasionally with thin, rust-resisting oil. Before power is applied, each contactor and relay should be operated by

hand to see that the moving parts operate freely and without binding. All electric interlocks should be clean and should make good contact when closed.

Resistor boxes should always be mounted with the grids in a vertical plane, and should be so located that free ventilation is permitted. To keep heating at a minimum, it is recommended that six-inch spacers be used between boxes when stacked, and that the stacks be 12 inches apart. Such an arrangement is desirable when continuous or heavy intermittent duty is expected, and

essential when boxes are stacked over six high. Slow-burning or noninflammable wire should be used in connecting to resistor terminals, to withstand the heat from the resistor.

Contractors are designed to operate properly if the line voltage is within 85 to 110 per cent of the panel nameplate rating for a-c circuits, and within 80 to 110 per cent for d-c circuits. Wider ranges require special devices.

The 10% Voltage Increase

Where there is a continuous 10 per cent increase in voltage, suitable coils should be ordered, because, with this increase in voltage there is an approximate 50 per cent increase in wattage, which greatly increases the heating of the coil. While this will not cause immediate failure of the coil, the deterioration of the insulation is more rapid and the ultimate life of the coil is shortened. There is also an increase of 20 per cent in the pounding effect, resulting in a more rapid deformation of the armature, crystallization of the magnet parts, breaking of the contact tips, and increased noise.

The armatures should seal when the proper voltage is applied to the coils and should open by gravity when the power is cut off. All contact tips should, when closed, make line contact near the bottom of the face. On opening, the final break will be near the top. The rolling and wiping motions when closing and opening keep the contacts in good condition.

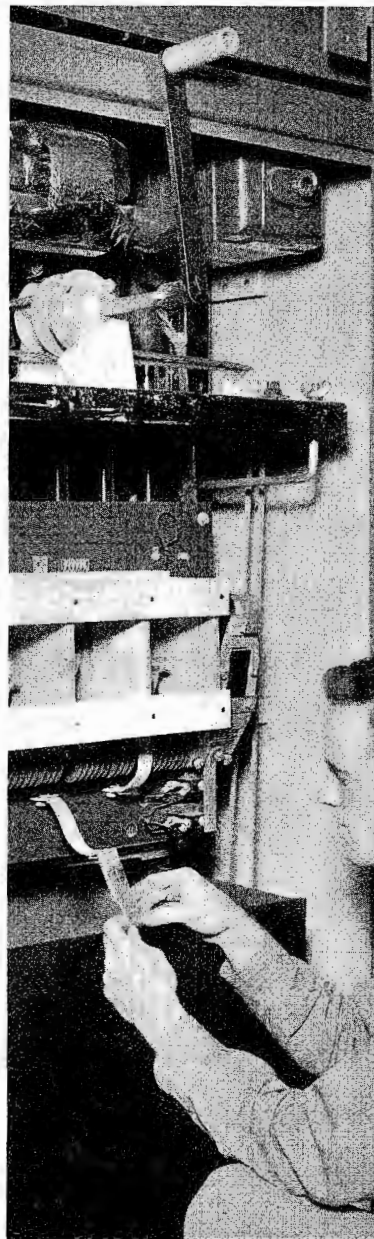
Electrical Interlocks

Electrical interlocks are adjusted at the factory to make contact at approximately the same time that the main contactor tips touch, or even a trifle later. For some special applications the interlocks may make contact before the main tips touch, but, in general, the above instructions apply. To change the adjustment, loosen the nuts on the front and back of the base and screw the stud in or out to suit the conditions.

Mechanical interlocks are so adjusted that, with one contactor in the sealed (closed) position, there is a very small play on the other contactor. This play must not allow the moving contacts of the second contactor to touch the corresponding stationary tips when the tips of the first contactor are just touching.

There are two types of maintenance. One concerns prevention of trouble and other concerns curing the trouble, once it has occurred.

The first consideration in the preventive campaign is to prevent an accumulation of dirt, oil, grease or water on the operating parts of the control. It



Replacing a movable contact on a 2300-volt motor control. Renewal parts should be kept handy at all times so that replacements can be made quickly.

is, therefore, advisable to carry in stock protective paints for the stationary iron parts, and insulating varnish of the proper characteristics for the coils.

Where the air is saturated with moisture, or subject to the action of corrosive gases, it is well to inspect and paint the various control parts from two to four times a year, depending on the severity of the operation conditions.

Heaters to Prevent Condensation

It is often desirable to add heaters or lamps within the controller enclosure to prevent condensation of excessive

moisture. For best results, such heaters should be energized continuously, especially when the controller is not being used.

Circuit breakers or contactors are usually of very rugged construction. Still, it is best to operate them by hand from time to time and check to make sure that all of the clearances are normal and that parts are working freely. Should parts become worn so that adjustments cannot be maintained, new parts should be used. Adjustment and cleaning, as well as renewal of the tips, is necessary and depends on the frequency of operation of each device. In the case of contactors, for example, the armature should be cleaned and checked for free working and the condition of the magnet contact surfaces.

Occasional Inspection

Occasional inspection should be made of all nuts and connection wires on panels and resistors, particularly when subject to vibration. Close inspection of pigtail connections should be made periodically since these are of finely woven wire for flexibility. In extremely corrosive atmospheres pigtail connections have been known to fall apart before there was any apparent indication of failure.

Float Switches

Float switches should be given the best of care, especially if they are of the moving contact type. The tips should be adjusted and lined up properly and, of course, cleaned if any indication of excessive corrosion is noted. The bearings should be made free to operate and any tendency towards binding should be corrected immediately.

In float switches of the mercury contact type, the mercury tubes should be held tightly in place, and if inspection shows that the tubes are becoming dark, it may be an indication of air leakage and the tubes should be renewed.

Troubles are bound to occur in the best of control equipment. Knowing what to do about them when they do occur will save much precious production time. The remainder of this article will discuss some of the more common types of trouble which the maintenance force encounters with control devices, show the causes of such troubles, and explain how to stay one jump ahead of them. If the fundamental cause of each trouble is understood, the remedy will quite likely be apparent, and ways will be found to lessen the resultant trouble.

A contactor has several bolted or spring-closed contacts. Excessively high resistance at these contacts is the cause of the very high temperatures, such as

100 to 200 C, that may be reached when the contactor is carrying rated current or less. The most likely point of high resistance is at the contact where the movable tip makes contact with the stationary tips.

However, high resistance may occur at any of the several bolted joints on the contactor. Therefore, if one of these devices begins to develop an excessive temperature, a millivoltmeter should be used to determine which of the several joints has a high-voltage drop across it. An a-c millivoltmeter is now available that can be used for checking the voltage drop on a-c contactors.

Copper Contact Maintenance

When the copper contact or contacts that have excessive drop across them have been located, correction can be made by opening the contact and removing the oxide with a file (not with sandpaper or carborundum paper). It is unusual to find a high resistance in a bolted joint unless the contactor has previously reached very excessive temperatures. However, when excessive resistances are found in joints the cause should be removed.

Since high resistance will most commonly be found in the active contact, it is a very simple matter to inspect these tips weekly or monthly. If the temperature is unduly high, the tips

should be given a few strokes with a file.

The foregoing comments apply particularly to copper contacts because they oxidize readily, and the copper oxide formed has a very high resistance. A file will remove the oxide and reduce the resistance to a low value again. Depending on various conditions, it may take a short or long time for the formation of sufficient oxide to cause excessive heating under ordinary types of service.

Sulphur Gas Film

However, if sulphur gas is present, a high-resistance film will develop quite rapidly. To prevent this action, the contactor should be mounted in a tightly gasketed enclosing case, or immersed in oil.

Sometimes it is not practicable to keep the resistance of contacts low by filing them. When it is desired or necessary to maintain a low resistance of the active contact without servicing, a silver face can be brazed to the two tips so that the contact is made through that metal. Silver will oxidize and the oxide has a higher resistance than the pure metal, but, when heated, silver oxide has the unusual property of reverting back to the metallic form. Therefore, silver contacts are self-purifying.

Electrical interlocks may fail to make

circuit because of oxidation where copper contacts are used. Sometimes such failure occurs because dirt gets between the contacts. By using one hemispherical and one flat tip made of silver, both of these troubles will be overcome. The point of the hemispherical tip will make contact without trapping dirt particles between it and the flat tip, and the use of silver will overcome the oxide trouble occasioned by oxidation when copper contacts are used.

Excessive wear on the contact tips of a contactor indicates that it is operated frequently. For conditions of this kind, silver should not be used for the contacts, because it does not have the ability to stand up under this severe service as well as copper.

If the service is unusually heavy, and if the root-mean-square of the current is not more than equivalent to three-fourths of the contactor's rating, the tip can be faced with a certain alloy that will last several times longer than copper tips. The cost of this material is quite high, but its use is sometimes warranted.

Contact Tips

Some maintenance men have the erroneous impression that contact tips that have been roughened by service should be kept smoothed up so that they will carry the load. A roughened tip will carry current just as well as a smooth tip.

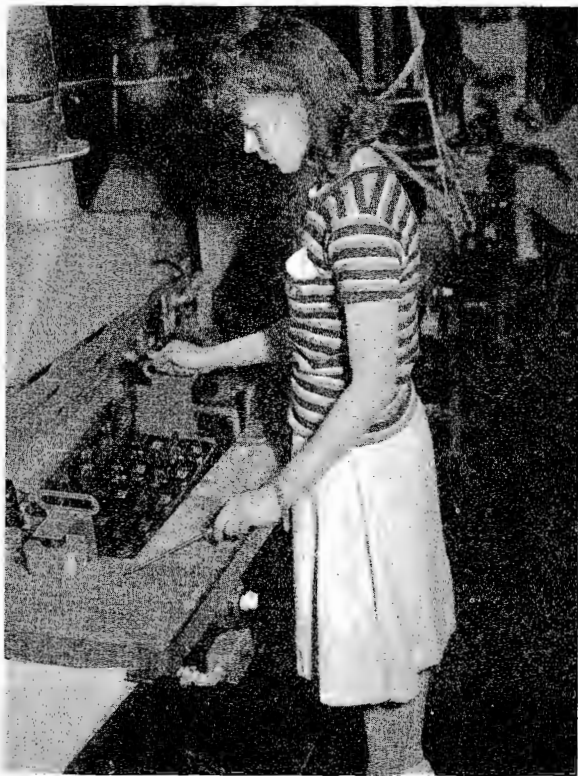
Of course, if a large projection should appear on a tip because of unusual arcing it should be removed. However, a tip that has been roughened by ordinary arcing need not be serviced. If a copper tip becomes overheated, this condition indicates that oxide has developed and should be removed.

Contactor Coil Problems

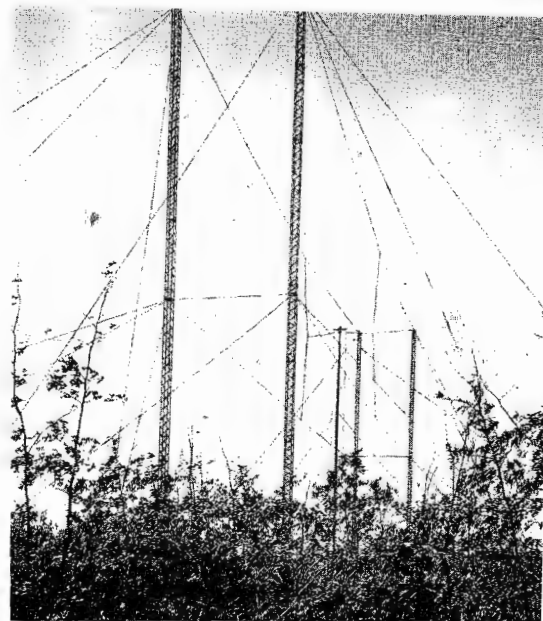
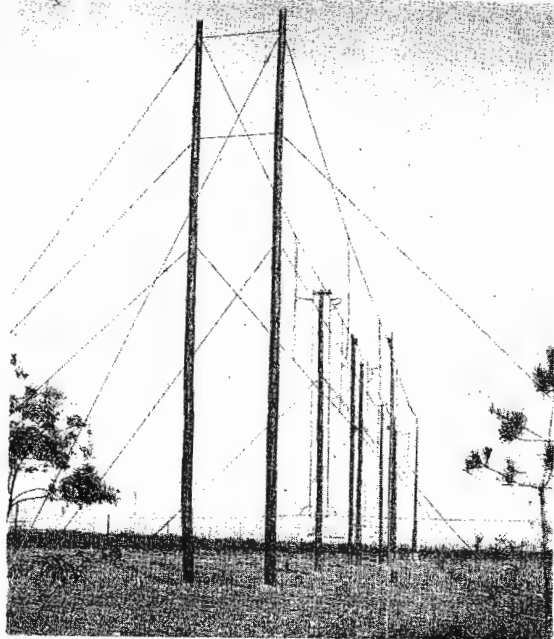
A large percentage of contactor coil troubles can be traced back to heating. Therefore, if the temperature can be reduced coil troubles can be greatly decreased. Since the heating of a d-c coil will vary as the square of the voltage, and the heating of an a-c coil will vary about as the cube of the voltage, it follows that coils should be wound for the voltage that exists on the line. If the ambient temperature is high, this precaution is all the more important.

When an a-c magnet, such as a solenoid, is supplied with constant-voltage excitation it requires a large inrush of current to close the armature. When the armature closes, the coil current drops to a normal value. Sometimes armatures may not close because of excess friction or for some other reason and the

(Continued on page 27)



Temperature overload relays are inspected before leaving the factory. If a relay does not function properly it should be immersed in a pail of water kept at 90° C (as shown above) and adjusted so that it will.



Key Stations

FOR NEW CBS LATIN-AMERICAN NETWORK



ONE of the most unique networks went on the air recently, when three direct circuits linked New York City to the outskirts of the city to open the new 76 station Latin-America CBS system. At the outskirt point, three transmitters went into operation to spray signals in a variety of directions to twenty neighbor republics.

Two of the transmitters used in this operation are 50,000 watt affairs with the call letters, WCBX and WCRC. An additional transmitter is of 10,000 watt power, with the call letters WCDA.

One of the features of the 50 kw transmitters are the three r-f amplifiers, which may be connected easily and quickly to either of two sets of modulating equipment and with any of thirteen antenna systems. Of the thirteen-directional systems, four direct on a beam on the West coastal region of South America, three on the East coast region of South America, one on Mexico and Central America, one on Europe,

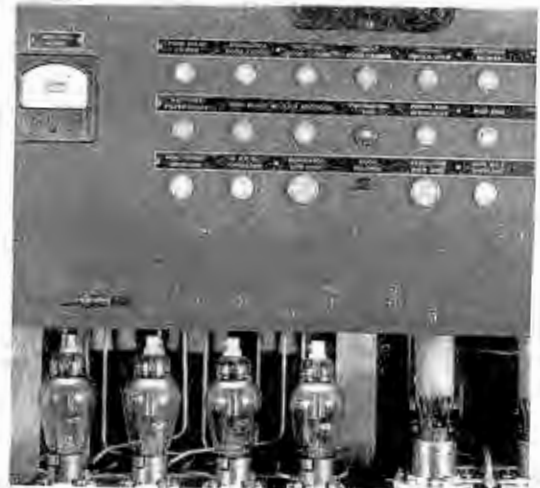
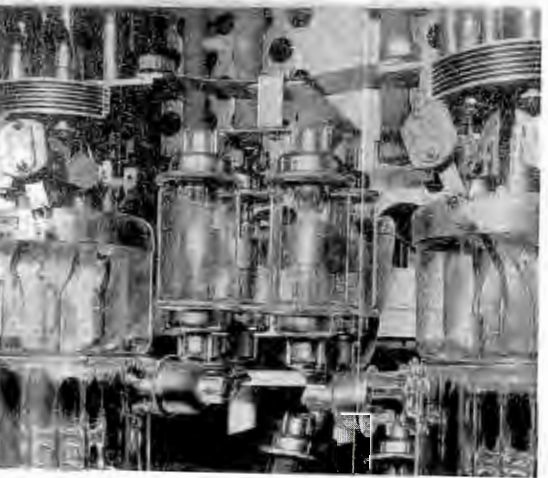
(Continued on page 33)



Illustrations

Top left, 70-foot antenna for West Coast of South America; second from top left, antenna reversing switch; third from top left, sections of antenna switch units in transmission building, and bottom, r-f final amplifier tubes and condensers.

Top right, 150-foot antenna towers for Central America transmission; second from top right, r-f exciter units; third from top right, audio control board and measuring equipment, and bottom, modulator unit.



A Report on the 20th ANNUAL NAB CONVENTION

by LEWIS WINNER

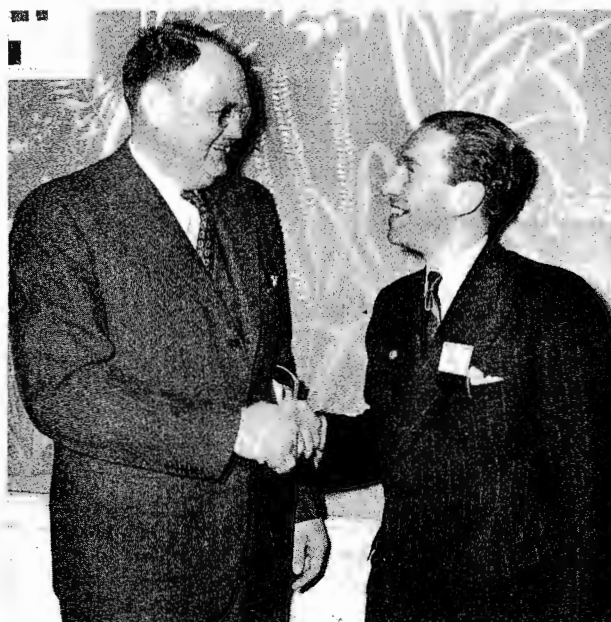
Editor

MANPOWER . . . materiel . . . replacements . . . pooling . . . conservation . . . priorities . . . training. These were but a few of the pulse-racing topics that filled the meeting halls at the recent 20th annual convention of the National Association of Broadcasters at Cleveland. And it was difficult to find just which topic might be aptly termed the most critical or the gravest problem, aware as everyone was and is of the relative dependency of each of these on each other.

Before over a thousand executives and engineers appeared specialists from Washington and home to offer analyses . . . interpretations . . . suggestions . . . aids to the variety of problems that now prevail in industry.

In a talk on the draft, Selective Service head Brigadier General Lewis B. Hershey analyzed the demands of Government and industry for manpower. General Hershey pointed out that the importance of the industry was recognized, recognized as a contributing ef-

Andrew D. Ring, former assistant chief engineer of the FCC and presently consulting engineer and secretary of the DCB broadcast committee, and Lewis Winner, editor of COMMUNICATIONS, at one of the technical round table sessions during the NAB convention.



fort in respect to the war. But similarly, the men required to run the machinery of broadcasting were essential

to the fight on the other side of the fence. Thus the problem of selection for one or the other was a tense one, he continued. All considerations are being given, and the widest latitudes of allowances are being made, he pointed out. But, he said, if an emergency has to be met, we will meet it, and corresponding changes will thus have to be made in station operations. It may mean skeleton crew operation, but it's a condition that we cannot afford to overlook, he explained. It will mean hard work for those who remain behind, just as it will be tough for the boys on the other side, in the thick of the fight.

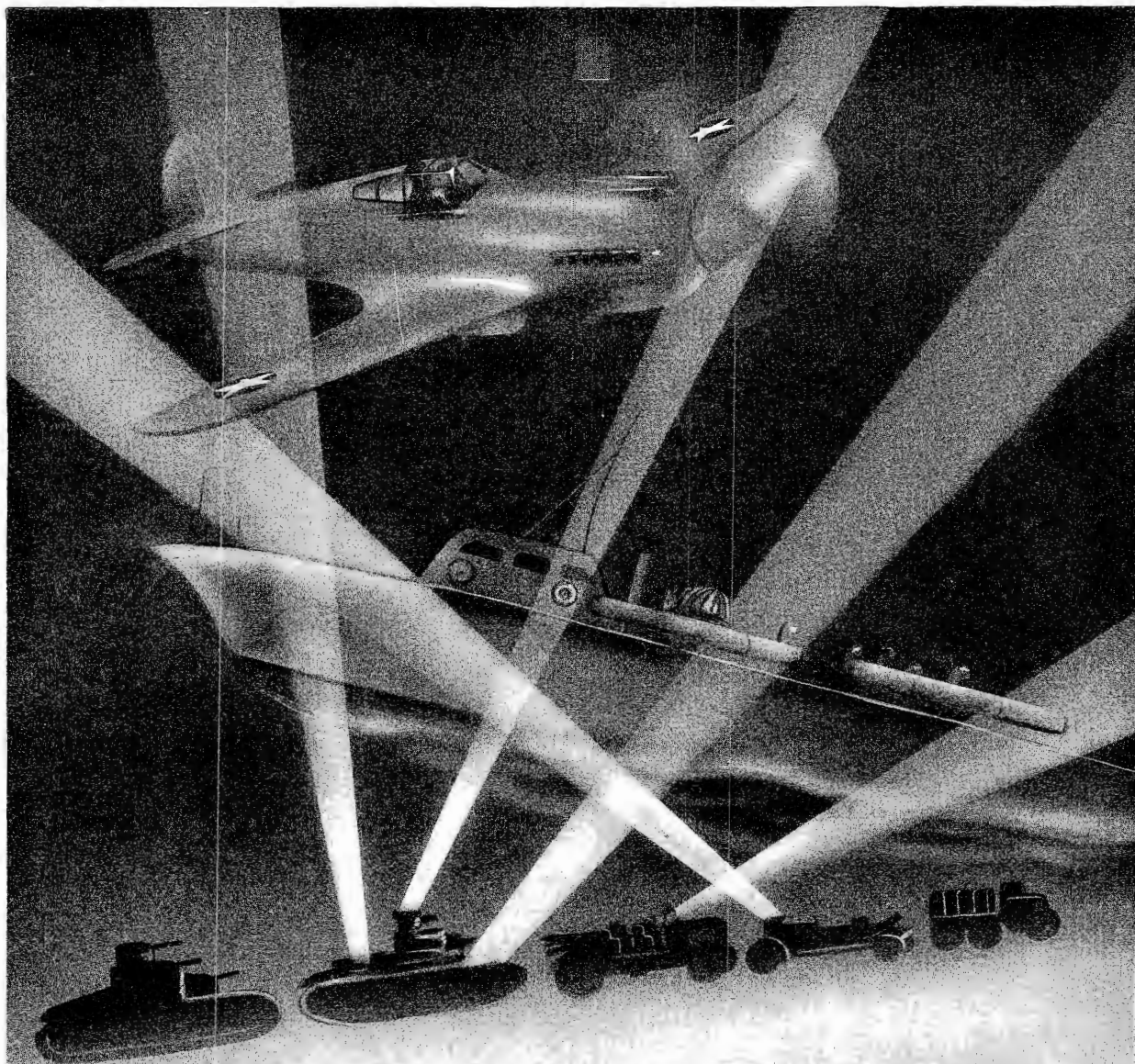
"We will be compelled as time goes on to take men who are not ideal for active service," he said, "but who can do something in the armed forces. The time may come in 1942 or 1943, but we must look forward to it.

"We must try also to maintain the American family unit," he added, "but get each man with dependents to make some contribution to the war effort, while he is maintaining dependencies."

To prepare for the exodus of technicians and to prepare for the thousands and thousands needed as technicians, hundreds of training schools have been set up. In commenting on this important phase, Arthur Stringer, secretary of the NAB war committee, told



J. D'Agostino (standing), of NBC, discussing sabotage, fire and theft in stations. Seated, left to right, are W. R. David, of G.E.; Lynne Smeby, of NAB, and I. A. Mantino, WDRC.



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In ever increasing quantities our radio communication equipment is being furnished to the Army and Navy as well as the military forces of the United Nations. Our products are "in action" on all fronts throughout the world—in the AIR, on the seven SEAS, and with the mechanized and mobile LAND forces everywhere, including the valiant HOME defense units both here and abroad.

Jefferson-Travis has gone "all out" for speedy Victory!

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Manufacturers of Aircraft, Marine and Mobile Radio Communication Equipment



Speakers at the NAB Convention, left to right, Brig. Gen. Lewis B. Hershey; Hon. Humphrey Mitchel, Canadian Minister of Labour and Selective Service head, and Major Gen. Beaumont-Nesbit, former director of British War Information, and at present with the British Embassy.

how the original estimate of 200,000 men necessary for the war effort, was now being doubled, and how, too, women were beginning to play an important role as technicians.

An interesting example of the results of this training course appeared in the case of Ruth Lloyd, a product of this Government training course. Now employed by station WGAR, in Cleveland, she is among the first to be engaged in such work. She was picked for the job because of her outstanding work in the radio engineering class at Fenn College, although she had no previous commercial experience.

The problem of material shortages and replacements were spotlight features at roundtable discussions headed by Neville Miller, president of the NAB and chairman of the DCB Committee of Domestic Broadcasting; Lynne C. Smeby, alternate for Neville Miller, technical adviser on Domestic Broadcasting Committee IV of DCB, and NAB director of engineering on leave, and Andrew D. Ring, former FCC assistant chief engineer and secretary of the DCB committee.

To maintain an effective continuity of service, the pooling plan suggested at the Ohio State Broadcast Conference was offered. This time, however, it was an official recommendation of the DCB. This pooling plan will be necessary, it was explained, even though the priorities rating for replacement parts has been raised from A-10 to A-3, for there are still many difficulties in obtaining

some parts, such as tubes. Pooling may afford a relaxation, for first it will provide not only the necessary material in an emergency, but provide, too, a source of information where national shortages actually exist. With such an authentic compilation of information, the WPB will probably allow the release of the necessary material for manufacture. To date, the WPB has not felt too keen about the acute shortages that exist among many products.

Thus, a nation-wide inventory of all

spare equipment will be necessary with plans for its allocation on a regular pay basis to stations in each of the seventeen NAB districts, where such equipment may be required. Three-man committees consisting of an executive familiar with station administration, a technical man known to the broadcasting stations in the area and a business manager, familiar with the stations and personnel in his area, were recommended. These committees will be selected by the broadcasting stations, in accordance with a plan that will be submitted by the DCB. Although the plan will be operated on a voluntary basis, Federal authority will be invoked where cooperation is lax. As an example, if the price offered for equipment is rejected, the proposal will be submitted to the DCB for a final discussion.

To assure the maximum operation of each station will be another job of the engineer serving on this committee. These checks will involve testing of the various allied components and equipment on all stations in the respective areas. Such checks will show up any deficiencies in operation, and consequent injury to parts. It will also show up those parts that require replacement. With such an impartial report, the availability of parts now considered difficult, should be simplified, it was explained.

This pooling of parts plan is actually an old friend of many engineers who have oftentimes called on engineers of their neighbor station to lend a hand with a part or parts not around at the moment. Of course, such exchanges were limited in scope, but the basis of friendly help prevailed and will be-

(Continued on page 34)

E. K. Cohan (left), CBS, director of engineering, and Lynne Smeby, of NAB, at one of the breakfast round table sessions, during which pooling and priorities were discussed. Mr. Cohan related the possibility of using six basic parts for replacements, to simplify the pooling program.



9 WAYS to Make Your Tungsten-filament Tubes LAST LONGER

Here are a few suggestions for prolonging the life of pure-tungsten-filament tubes. Specific installation and operating instructions are available for *every* General Electric tube, as well as general instructions for water-cooled and air-cooled types. Send us a list of the G-E tubes you use. We shall be glad to furnish you with complete service information. A brief review of these instruction sheets will enable you in many cases to get thousands of extra hours from hard-to-get tubes. *General Electric, Schenectady, N. Y.*



1 Keep filament voltage as low as possible consistent with output and permissible distortion.



2 Minimize anode dissipation by careful tuning of transmitter.



3 Be sure there is plenty of water flowing on water-cooled anodes and plenty of air on air-cooled anodes to prevent hot-spotting and gassing.



4 Keep plenty of air on the glass bulb—particularly on the seals where glass joins metal or leads go through—to reduce electrolysis and gas evolution from glass.



5 Switch leads every 500 hours, preferably once a week, when filaments operate on d-c.



6 During starting cycle be sure the instantaneous current does not exceed 150 per cent of normal current.



7 Raise plate voltage in easy steps when starting.



8 Prevent damage caused by overloading the plate circuit. Use protective devices such as a fuse or relay.



9 Hard water (over 10 grains per gallon) should not be used for water-cooling. Distilled water will reduce scale formation on anode.



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OF DEVELOPMENT

NEWS BRIEFS OF THE MONTH...

SMPE CONVENTION DELEGATES HEAR VITAL SOUND DATA; SEE DEMONSTRATIONS ON TELEVISION AND SOUND

Facilities for adapting motion pictures to television transmission were among the projects demonstrated to the delegates to the 51st semi-annual convention of the Society of Motion Picture Engineers. This new equipment was developed by Television Production, Inc., a Paramount affiliate. Portable television camera equipment and other developments were also discussed.

Recordings used during another lecture, this one on "Recent Developments in Sound Control for the Legitimate Theatre and Opera" by Harold Burris-Meyer, of the Stevens Institute of Technology at Hoboken, N. J., illustrated many unusual effects now available.

Mr. Burris-Meyer opened his talk by describing means by which reverberation of sound can be controlled on recordings so that the acoustic properties of any other type building, such as a church, may be reproduced in a theatre. It is done by recording and re-recording the sound at different volume levels fractions of seconds apart. By controlling the volume and time elements, virtually any type of acoustic condition can be reproduced.

During another section of the convention G. L. Beers, of the RCA Laboratories, told of loud speaker development research.

Development of a new type of instrument which eases the burden of the theatre sound engineer in serving the sound reproducing systems used in modern movie houses was told by Adolph Goodman, of the RCA Service Division. It was pointed out that the instrument, described as an audio chanalyst, makes it possible to detect faults in sound systems by sending a signal through the system to the point of trouble in order to locate it.

* * *

NEW OHMITE 16-PAGE CATALOG

A new 16-page catalog, No. 18, listing over a thousand stock items in rheostats, resistors, tap switches, chokes and attenuators has been issued by the Ohmite Manufacturing Company, 4835 Flournoy Street, Chicago, Ill.

This new catalog is well illustrated. Descriptions, ratings, prices and other helpful information on the wide range of Ohmite stock types and sizes to simplify selection are included. Close control vitreous enameled rheostats ranging from 25 watts to 1,000 watts, Dividohm adjustable resistors from 10 to 200 watts, fixed resistors from 1 watt to 200 watts—in many resistance values, two types of tap switches and a wide variety of power line and r-f plate chokes are among the many items listed.

A free copy of the new catalog 18 is available for the asking.

* * *

WESTINGHOUSE CONVERTS TEXTILE PLANT

A long idle textile processing plant in Sunbury, Pa., has been converted for the manufacture of bulkier types of communication facilities for the Government by Westinghouse Electrical Manufacturing Co., Inc., East Pittsburgh, Pa.

LATIN-AMERICAN ENGINEERS TO STUDY HERE

Forbes W. Grant of Buenos Aires, Argentina, and Ambrosio Alliende Z. of Santiago, Chile, recipients of Latin-American scholarships offered by the New York City committee arrived recently to study U. S. communications, methods and practices. Both are employees of associated companies of I. T. & T. Grant (left, below) is a radio engineer with Compania Internacional de Radio Argentina which operates the radiotelephone service between Argentina and the United States and other countries, and Alliende is with the long distance department of the Chile Telephone Company. Others, representing most of the Latin-American countries, will also soon appear for studies.



* * *

HANDY WIRE DATA-CARD FREE

The Callite Tungsten Corporation, Wire Division, Union City, N. J., is offering, without charge, a handy wire data chart that will be useful to every engineer who has occasion to employ wire in his designs or specifications.

On its face in columnar tabulation are given the B & S, Washburn & Moen, and the Stubs or Birmingham diameters for gauge sizes 1 to 50. In addition, the B & S column shows feet per pound for each size of standard 5% phosphor bronze. Directly below this chart is a table of conversion factors for use in obtaining the ft./lb. values for 15 other common wire materials. Along one edge is an inch rule, divided into 16ths.

On the reverse side is a tabulation which gives for each of these 15 the details of (1) nominal analysis composition; (2) approximate tensile strength for hard and soft grades, in pounds per square inch; (3) approximate percentage of elongation for hard and soft and (4) density in pounds per cubic inch.



BAILEY AND DEELEY BECOME V-P's OF C-D

William M. Bailey and Paul McKnight Deeley were recently elected vice-presidents of the Cornell-Dubilier Electric Corporation, South Plainfield, N. J.

Both of these men have been actively associated with the company since its formation, Mr. Bailey as chief engineer in charge of the Industrial and Transmitter Capacitor Divisions, and Mr. Deeley in charge of the Chemical Laboratories, the Electrolytic Capacitor Division and the Export Division.

* * *

50,000 WAR WORKERS TRAINED BY G.E.

General Electric has trained 50,000 new employees for war work and put them on regular production in the past eighteen months.

A former orchestra leader, Benny Rapp, now operates a huge planer in one of the Pennsylvania G-E plants and recently received a bonus for suggesting a better way to do a job. An ordained Baptist minister works six days a week on war work in the same plant and on Sunday conducts services in his church. In a midwest G-E plant, a former head waitress is now leader of a dozen girls making magnetos for fighting planes.

* * *

NEW SHALLCROSS BULLETIN

Bulletin "D" has recently been issued by the Shallcross Mfg. Company, Collingdale, Penn. It features two Shallcross wheatstone bridges, the 638-1 and the 621-A.

The 638-1 Kelvin-Wheatstone bridge combines, in one instrument, the features of both the Wheatstone and the Kelvin Bridges. The 621-A percent limit bridge's outstanding feature is said to be the independent setting of the plus and minus tolerances.

Supplementary sheets for this bulletin will be issued from time to time on other Shallcross bridges.

* * *

SECOND PRINTING OF GHIRARDI'S HANDBOOK

A second printing of the second edition of Ghirardi's "Radio Troubleshooter's Handbook" is now on the presses.

In reprinting his handbook, Ghirardi is adding data on 1942 receiver models, on new tube types and on battery replacements for 1942 portables. Electrical wiring diagrams, ignition system and radio installation data for the 1942 automobiles are presented as are also additional case histories covering commercial receivers. The tube characteristics and basing charts are completely revised to provide complete information on more than 1,000 commercial receiving tubes, plus nearly 400 army, navy and "Multiple-etched" types. The trade directory sections have also been brought up to the present date.

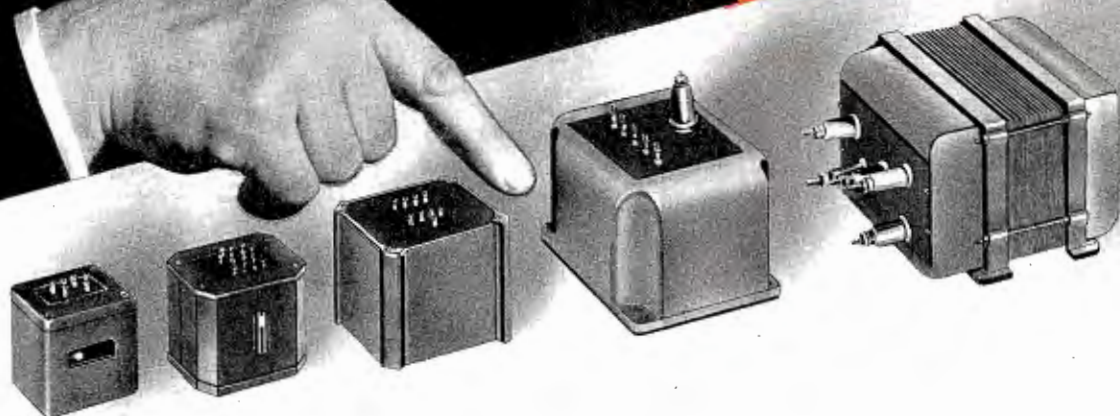
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STATION W47A INSTALLS ST EQUIPMENT

Whereas most radio programs are carried by telephone wire from the studio to a transmitter, usually located many miles from the studio, a few f-m stations lately have installed special studio transmitter equipment to relay programs to the main

(Continued on page 29)

**EENEE
MEENEE
MINEE
MO**



There are many ways of choosing a transformer
...there are even *more ways of making one*

Where a stock item can do the job, by all means standardize. (The UTC catalogue covers over four hundred types.) But, the ideal transformer for a specific job doesn't just happen...it's designed. For example, after extensive development, UTC reduced the weight of an important aircraft item over 90%. Let UTC design a unit to your specific problem.

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VETERAN WIRELESS OPERATORS ASSOCIATION NEWS

W. J. McGONIGLE, President

RCA BUILDING, 30 Rockefeller Plaza, New York, N. Y.

GEORGE H. CLARK, Secretary

SCHOLARSHIPS

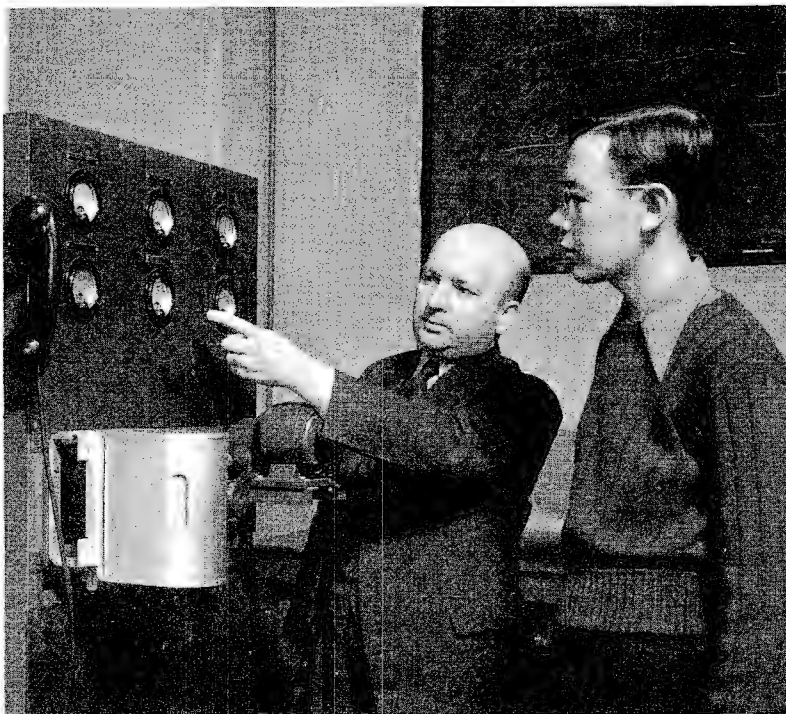
WE have learned from J. R. Poppele, life member and chairman of our Scholarship Committee, that a contest will be held in the near future among the senior students of the high schools of the United States, which have Science and Engineering Clubs affiliated with the American Institute of the City of New York and Science Service to determine a winner for our Annual Marconi Memorial Scholarships. A two-year scholarship in radio and electrical communication at RCA Institutes will be presented to the National winner. A scholarship for a comprehensive course in aviation radio at the Midland Radio and Television Schools will be presented to the highest ranking contestant in the Midwest. The scholarships are made available by our association through the fine cooperation of C. J. Pan-nill, president of RCA Institutes and G. P. Taylor, president of the Midland Radio and Television School.

Our first scholarship winner, Robert Barkey, after completing the course at RCA Institutes, was immediately engaged by "Jack" Poppele in the engineering department of WOR, of which Mr. Poppele is chief engineer. We understand "Bob" Barkey is doing a nice job.

At the present time we have five scholarship students in training. In the RCA Institutes in New York we have Robert Stahl of Redwood City, Cal., who will be graduating this summer. He is a fine student and bids for his services will now be accepted. Graduating next summer are John Marsey of Youngstown, Ohio, and Stanley Goldfein of Brooklyn, N. Y. Training under Mr. Taylor's direction at the Midland Radio and Television School we have Robert Humble, who will be available shortly as an expert in aviation radio.

PERSONALS

"BILL" SIMON, our honorable treasurer, in addition to his duties as Marine Radio Superintendent of the Tropical Radio Telegraph Company, also fills the post of general manager of the Tropical Radio Service Corporation. Despite his many business activities, "Bill" has been most cooperative in VWOA affairs these many years. Fred Muller, a former president of our association, is now serving as Radio Materiel officer of the Third Naval District with the rank of Lieut. Commander. . . . V. H. C. Eberlin, a former treasurer of our Association and more recently chairman of the Miami Chapter of our Association, is now Radio Officer of the Jacksonville Naval Air Station at Jacksonville, Fla. . . . Henry Hayden, who always shows up at VWOA meetings wherever they are held, is busily engaged with Ward Leonard in getting out Government contracts. . . . Paul K. Trautwein, chairman of our finance committee, continues active in Association af-



G. P. Taylor, president of Midland Radio and Television, with Robert Humble, a VWOA scholarship student.

fairs and as president of the Mirror Record Corporation is coping with the problems accruing from the shellac shortage. . . . George H. Clark, a former president of our Association, now doing a splendid job as secretary, left the April meeting in New York at an early hour to attend to his duties as an Air Raid Warden. . . . "Bill" Marshall, an associate of our prexy in the Telephone Company, was recently elected Commander of the Aviation Garrison of the Army and Navy Union, a nationwide organization of present-day and former Army and Navy personnel. . . . Glad to see C. D. Guthrie, a pioneer director of our Association, now Supervisor of Radio for the Maritime Commission in New York at our last cruise. . . . Karl Baarslag, author of "SOS to the Rescue," "Coast Guard to the Rescue" and several other books, is now serving as a Lieutenant in the United States Navy stationed in Washington. Karl, on April 18th, took unto himself a bride. Congratulations may be sent to them at 2308 Wisconsin Avenue, Washington, D. C.

We should like to have the details of your present activity for this page. If you have joined the Armed forces, send us the information of your location and activities,

as long as they are not military secrets.

We had interesting reports from our Chicago and Boston Chapters concerning their recent cruises. In the effort to clear up the affairs of our recent cruise and awards we misplaced them. We shall be glad to receive copies of these reports for publication here. That goes for all chapters, including the New Orleans Chapter under the leadership of A. F. "Steve" Wallis, chairman. "Bill" Halligan, president of Hallicrafters, life member of our Association, and for several years past chairman of our Chicago chapter, did his usual fine job on the recent dinner-cruise in Chicago. "Bill" has always been ready and willing to do the best possible job in the interests of our Association. Some day we hope to write a piece about him in tribute to his fine contributions to the radio field in general. For the present, though, he should be proud that his competitors, all of them, speak well of him—the greatest tribute for which any man can hope. Due to the pressure of Government contracts, "Bill" relinquished the job of Chicago chapter chairman this year. Good luck, Bill, and thanks for your grand support.

E. A. Nicholas, life member of our As-

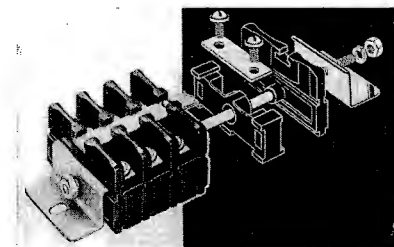
(Continued on page 32)

THE INDUSTRY OFFERS . . . — . . . — . . . —

TERMINAL BLOCKS IN KIT FORM

Built-up terminal blocks made by Curtis Development and Mfg. Co., 1 North Crawford Avenue, Chicago, Ill., are now available in kit form. In order to facilitate easy ordering, the parts have been assembled in two kits. The CDM-100 Kit contains 50 center barriers and terminals while the CDM-101 Kit contains five sets of end barriers, mounting brackets, marking strip, threaded through rod and other necessary hardware.

The moulded parts are said to have a tensile strength of 4000 pounds per square inch. The voltage breakdown at 60 cycles (50 per cent relative humidity) is approximately 375 volts per mil. All blocks that are assembled at the factory are subject to a 2500 volt flash test to ground.



NEW THIN SLOT INSULATIONS

New thin types of IRV-O-SLOT have been developed by Irvington Varnish & Insulator Company, Irvington, N. J. to provide non-bulking slot insulation for use in confined or limited space. They are resin coated fish paper, .006" to .016", 600 to 800 VPM; resin coated spauldo paper, .008" to .016", 600 to 800 VPM; varnished silk duplexed to fish paper, .009" to .011", 1050 to 1250 VPM; special thin varnished cambric duplexed to fish paper, .009", 800 to 1000 VPM and duplexed to spauldo paper, .011", 800 to 1000 VPM; varnished fiberglass duplexed to fish paper, .009" to .013", 800 to 1000 VPM and duplexed to spauldo paper, .011" to .013", 800 to 1000 VPM.

IRV-O-SLOT insulation consists of Fish or Spauldo papers coated with resin, or bonded by means of a plastic insulator, to cambric, silk or Fiberglas.



GOULD-MOODY DISCS

Glass-base discs are now being made by Gould-Moody Co., 395 Broadway, N. Y. City. Features are said to be: 1)—All glass discs in either a thin, flexible weight, or medium weight in 10-12 and 16-inch sizes; 2)—both weights are available with either two or four holes; 3)—there are no fibre or other foreign material inserts that may loosen or fall out; 4)—there are no metal grommets around the holes which may cause objectionable "wow" or rumble, and 5)—for accuracy, the holes of BLACK SEAL discs are precision machined directly in the glass.

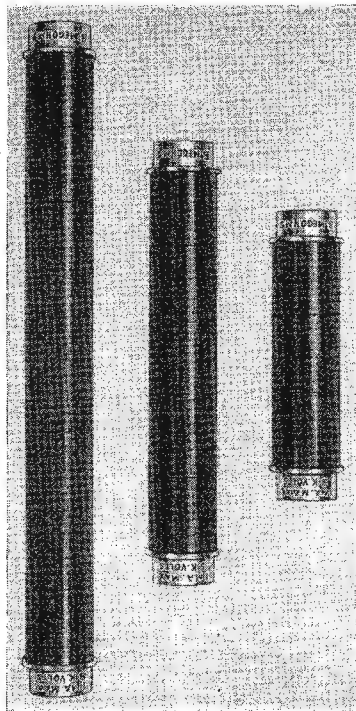
NEW SECTIONAL RESISTOR

For use in railway service, radio circuits, power rectifiers and laboratories, for measuring any high voltage a-c or d-c circuit of 250 to 30,000 volts, a new sectional resistor is announced by the Westinghouse Meter Division, Newark, N. J. The unit is designed to replace in certain cases, the old box type resistor which had a high power consumption and was inconvenient to install or replace.

Made up of individual, hermetically sealed units wire wound around a ceramic resistor spool, the resistor units have values of from 0.25 to one megohm and a rated current of one milliamper. Dimensions are 1 $\frac{3}{8}$ inches by 1 $\frac{1}{4}$ inches in diameter per section. The ceramic resistor spool is sectionalized, and adjacent sections are wound in opposite directions to obtain a non-inductive resistance.

Two nickel-plated brass shield cups are slipped over the spool before the outer cover is molded on. The cups, together with a phenolic retainer ring prevent the molded material from coming in contact with the spool during the molding process and also provide electrostatic shielding. Ends of the shield cup are tapped with a 10-32 thread. Units are connected electrically and mechanically by a 10-32 stud and mounting ferrules are held in place with a 10-32 screw.

Resistance is held within close tolerances permitting interchangeability of units having the same voltage rating. When a number of sections are mounted on one shaft, permanent taps may be taken off between any two sections, permitting a multiplicity of resistance combinations on one complete unit. For switchboard mounting, insulators are available in 7.5, 15 and 30-kv sizes.

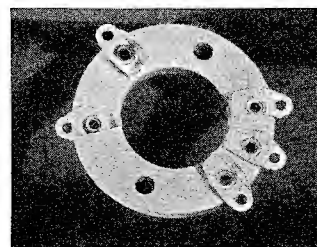


NEW FRANKLIN SOCKETS

Two new types of sockets have been produced by the A. W. Franklin Mfg. Corp., 175 Varick Street, N. C. City. One is a u-h-f acorn tube socket. This socket was designed to meet the rigid specifications of Army, Navy, and Signal Corps for special applications.

The Ceramic is of Grade "G" approved steatite, glazed on top and sides and impregnated in Cerese AA wax to prevent moisture absorption.

Contacts are of Grade "C" tempered phosphor bronze heavily silver plated to withstand 100 hour salt spray test, and so designed to hold tubes with a minimum of insertion pressure under severest vibration tests. Contact jaws are said to effect a "scissor hold" on tube pin, and assure electrical contact to tinned portion of same.

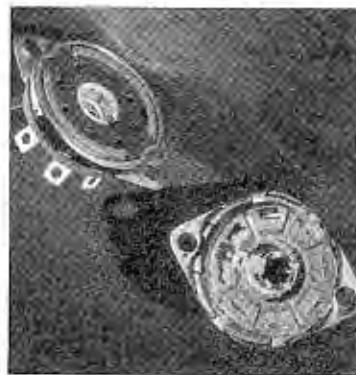


The other new socket is a low-loss type of the "lock-in" type for special applications for Army and Navy work.

The molded shell is of mica filled low loss Phenolic material for efficient operation at higher frequencies.

Contacts are of a new design. If, through abuse, a contact is distorted, it is only necessary, it is said, to force contact tail sideways several times and contact is restored to its normal contour with initial electrical and mechanical contact to tube pin.

Top Plate is of XXXX laminated stock or X2B hard rubber and locked to shell by a brass, heavily silver plated center piece. Locking Spring is made of 18-8 stainless steel and affords the required tension to maintain the tube in position during severe vibration tests. Mounting Shell is of brass, heavily nickel-plated and allows socket to be mounted on top of chassis with screws or rivets.



SILVER MICA CAPACITORS

The latest Solar catalog, No. 12, section E.

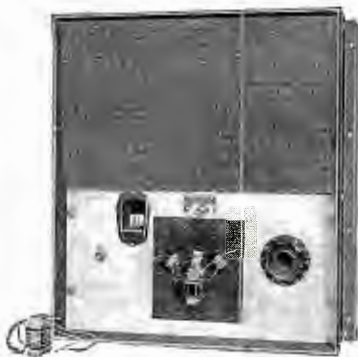
contains a description of silver-mica capacitors, types MWS, MOS, MKS and MLS. Capacities available are from .000001 mfd. to .002 mfd. Sizes are from 11/16" to 1", with tinned leads. The 1" type is also supplied with lugs.

* * *

COIL TESTING UNIT

Coil testing machines for checking the electrical properties of a coil in one handling have been developed by Photobell Corp., 116 Nassau St., N. Y. C. Tests are provided for checking the limits of insulation resistance, coil resistance, effective a-c resistance, inductance, and shorted turns. Additional tests are for checking effective turns, direction of windings, and other properties. There are two types of machine, the automatic and semi-automatic. Each machine has a holder adapted to the special shapes of coils to be tested.

Illustrated is the semi-automatic type, capable of making eleven tests in quick succession on each coil, and checking up to 250 coils per hour. The machine checks the resistance of each winding by the "high-low bridge" method; checks the effective a-c resistance at 900 cycles; checks the direction of each winding; and finally checks the high and low limits of inductance.



* * *

GENERAL ELECTRIC'S NEW RELAYS AND DYNAMOTORS

A new sensitive direct-current relay for aircraft service has been produced by the industrial control division of G.E. The relay, designated CR2791-C100C, is specially designed for use in vacuum tube output circuits where the power available is so small as to require operation on extremely low currents. The relay weighs 3 3/4 ounces.

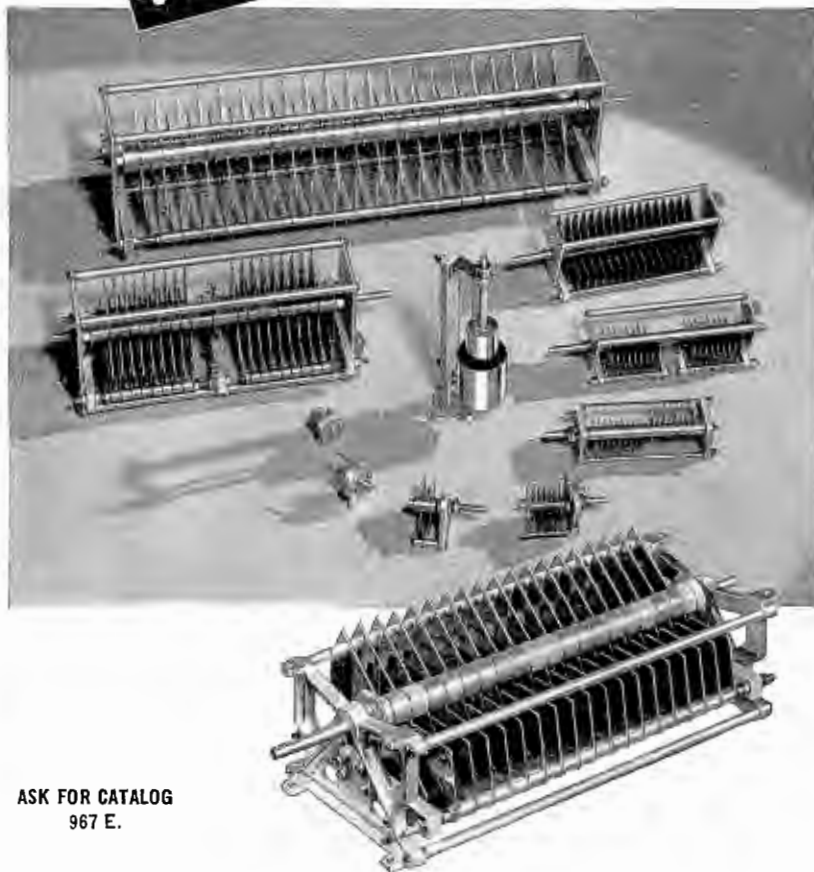
It has a maximum continuous current rating of 2 amperes at 32 volts, and a maximum make or break rating of 10 amperes. The coil is rated at 32 milliwatts minimum and 1 watt maximum. Maximum coil resistance is 3000 ohms. The contacts provide singlepole, double-throw operation.

A new dynamotor line for communication and other service in aircraft, tanks, and mobile field equipment has also been developed by G.E. Five types, ranging from 25 to 600 watts in output, and from 3 to 31 pounds in weight are available. Formex wire insulation, light weight, and reliability under rigorous conditions are features. Each unit is designed for high output from a small frame size.

Objectionable a-c ripple is said to be kept at a value which requires a minimum of filter to provide satisfactory operation of the communication equipment.

Other features are: spiraled armature
(Continued on page 25)

JOHNSON for condensers



ASK FOR CATALOG
967 E.

Although 100% of Johnson's production has been strictly for National Defense for several months, no attempt has been made to capitalize on this angle in advertising. It is being mentioned now only as an explanation of why a few orders were not shipped promptly. Johnson is operating three shifts and producing close to ten times as many parts as a few months ago.

Regardless of the need, if its variable condensers Johnson has the answer. Pictured in order of size are types K, J, G, H, F, E, D and C. Type B, at the bottom, is available in spacings up to 3/4 inch and the big type A up to 1 1/2 inches. Type N neutralizing condenser, shown in the center is furnished in several sizes and gas filled (pressure type) are also available in several sizes.



E. F. JOHNSON CO.

WASECA, MINNESOTA

EXPORT: 25 WARREN ST., NEW YORK, N. Y.

"MANUFACTURERS OF RADIO TRANSMITTING EQUIPMENT"



Next to the Stars and Stripes . . .

AS PROUD A FLAG AS INDUSTRY CAN FLY

Signifying 90 Percent or More Employee Participation in the Pay-Roll Savings Plan

IT doesn't go into the smoke of battle, but wherever you see this flag you know that it spells Victory for our boys on the fighting fronts. To everyone, it means that the firm which flies it has attained 90 percent or more employee participation in the Pay-Roll Savings Plan . . . that their employees are turning a part of their earnings into tanks and planes and guns *regularly*, every pay day, through the systematic purchase of U. S. War Bonds.

You don't need to be engaged in war production activity to fly this flag. Any patriotic firm can qualify and make a vital contribution to Victory by making the Pay-Roll Savings Plan available to its employees, and by securing 90 percent or more employee participation. Then notify your State Defense Savings Staff Administrator that

you have reached the goal. He will tell you how you may obtain your flag.

If your firm has already installed the Pay-Roll Savings Plan, now is the time to increase your efforts: (1) To secure wider participation and reach the 90-percent goal; (2) to encourage employees to increase their allotments until 10 percent or more of your gross pay roll is subscribed for Bonds. "Token" allotments will not win this war any more than "token" resistance will keep our enemies from our shores, our homes. If your firm has yet to install the Plan, remember, **TIME IS SHORT.**

Write or wire for full facts and literature on installing your Pay-Roll Savings Plan now. Address Treasury Department, Section D, 709 12th St., NW., Washington, D. C.

Make Every Pay Day "Bond Day"



U. S. WAR Bonds ★ Stamps

(Continued from page 23)

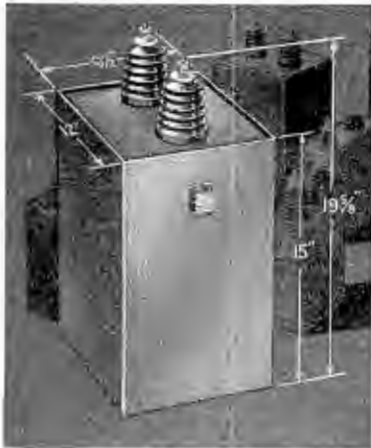
punchings to reduce noise and eliminate locking effect; carefully selected ball bearings with provision for lubrication and cleaning, and a stator formed from stainless-steel tubing.

* * *

HIGH-VOLTAGE HEAVY-DUTY OIL CAPACITORS

Type 20 heavy-duty oil capacitors have been developed by the Aerovox Corporation, New Bedford, Mass. These oil capacitors cover voltage ratings from 6000 to 50,000 d-c-w, including dual-section units for voltage-doubling circuits of 12,500-12,500 volts or 25,000 volts output, in 0.25-0.25 and 0.5-0.5 mfd.

Because of the Hyvol dielectric oil used, these capacitors are said to maintain their full rated capacity even at freezing temperatures, making them satisfactory for outdoor installations. The capacitors are hermetically sealed in welded steel containers finished in rustproof and corrosion-proof dark grey lacquer, together with cork-gasketed pressure-sealed glazed porcelain high-tension pillar terminals, affording immunity to humidity, temperature and climatic conditions generally.



* * *

PLASTIC CAPACITOR CONTAINERS

Inverted type, tubular capacitors with lock-nut in plastics for chassis top installation have been announced by American Condenser Corp., 2508 S. Michigan Avenue, Chicago, Ill. They are said to be available in single or multiple units over a wide range of capacities and working voltages in both electrolytic and paper bypass types. Insulated leads are supplied.

* * *

NEW PRECISION VACUUM TUBE MULTI-RANGE TESTER

A new electronic measuring instrument, the EV-10, has been developed by Precision Apparatus Co., Brooklyn, N. Y.

The instrument combines both vtvm as well as standard 1000 ohms per volt a-c/dc test circuits.

Incorporating a voltage regulated bridge type circuit, Series EV-10 provides the following ranges on an 8½ inch meter . . . eight zero-center vtvm ranges, from ±3 to ±6000 volts d-c; six circuit probing, zero-center, vtvm, ranges ±3 to ±600 volts d-c; six ohmmeter-megohmmeter ranges up to 2000 megohms; eight a-c and eight d-c

(Continued on page 28)

For U. H. F. —

The Model 75



Our new model 75 U.H.F. Standard Signal Generator extends the range of accurate receiver measurements up to 400 megacycles.

MEASUREMENTS CORPORATION

BOONTON



NEW JERSEY

BLILEY CRYSTAL UNITS

PRECISION-BUILT . . . For Reliable Frequency Control



Accuracy and dependability are built into every Bliley Crystal Unit. Specify BLILEY for assured performance.

BLILEY ELECTRIC CO., ERIE, PA.

AIRLINE RADIO MAINTENANCE

(Continued from page 7)

the outside of the loop antenna is another loop. This is the loop of the test device which connects to a signal generator. It is possible to rotate the test loop at any angle about the center of the automatic direction finder loop. The position of the test loop is read on the test panel and the indicator (shown near the operator's hand) shows the resulting bearing. The bearing as read on the indicator should be that shown on the test panel, plus or minus the correction supplied by the cam and accurately known. It is also possible to check the indicator and tuning unit with the device shown in Figure 4. This is done by plugging the device to be tested into the panel near the operator's hand. If the radio equipment and the loop are known to be in good working order the indicator and tuning unit can be checked.

Checking Noisy Receivers

Still another interesting test device is shown in Figure 5. Many of the reports of poor operation received from pilots concern noisy receivers. It is necessary to know whether or not this noise is caused by vibration on the radio equipment. It has been the practice in the past to bounce the equipment on the top of a bench or to pound the various components with a wooden hammer. Quite often this practice causes the equipment to be damaged and does not serve to locate trouble. A vibration table that would scientifically accomplish this "thumping" was designed and is shown in Figure 5. Since this device is used in an attempt to locate noise in the receiver it is necessary that it produce vibration without noise. In order to do this a vibration machine was designed to operate from compressed air. The exhaust from the machine is led outside of the soundproof room and but small noise is heard. This test device is designed to operate at only one frequency, 30 cycles per second, and was chosen because it corresponds quite closely to the major vibration component in an airplane. In order to keep this speed constant the valve of the pneumatic cylinder is actuated by a synchronous motor. A valve connecting to the pneumatic cylinder will not allow air to enter the pneumatic cylinder without the valve motor being placed in operation. With the motor operating it is possible to operate the table by means of a foot pedal. The amplitude of vibration is controlled by an air valve. This amplitude is measured by electrical means. A small "U" shaped Alnico magnet is

Figure 6
To assure the utmost in aircraft headphone and microphone efficiency, this tester was designed. The unit consists of an artificial mouth and ear, sound-proof chamber, log amplifier, recorder, oscillator and power supplies. This unit affords a check on 15 units a day or one every half hour.



mounted to the rod which vibrates the table. In front of this magnet there is mounted the coil of a telephone type relay. The output terminals of this coil are connected to a rectifier type meter. This meter then reads proportional to amplitude. The meter is calibrated to read directly in "g" acceleration units. Another feature of this vibration table is the provision of contacts which interrupt the energizing circuit of a neon light mounted in a reflector. This serves as a stroboscope and allows the equipment to be observed under vibration conditions.

Important parts of an airplane's radio equipment are the microphone and headphone. Communication is not possible without the proper operation of these. Headphones are provided for each pilot and he carries them with him as a portion of his uniform. They must, however, be checked at frequent intervals. The microphone is connected permanently to the airplane and is checked at engine overhaul periods. While speaking of microphones, it is interesting to note that each pilot carries a sanitary plastic microphone cap which he places on the face of the airplane's microphone.

A large airline will have over 750 pairs of headphones and approximately 150 microphones. Since these must be checked at intervals of not more than three months it can be seen that it is necessary to check nearly 15 units per day or one every half hour. In order to do this the microphone-headphone tester shown in Figure 6 was designed. This

unit consists of an artificial mouth, an artificial ear, a soundproof chamber, a logarithmic amplifier, a recorder, an oscillator and the necessary power supplies. As each microphone or headphone is received, it is placed in front of the artificial mouth or ear. The previous frequency characteristic of the device is taken out of file and placed in the recorder. The pen on the recorder is removable so that it may be fitted with one having ink of a color different from that previously employed. A button is pressed and the oscillator slowly turns to 100 cycles. The recorder then turns on automatically and the oscillator frequency increases continuously to 7,000 cycles. In one and one-half minutes the characteristics of the microphone or headphone have been drawn in decibels on the chart. By inspection it is easy to determine whether the test unit has deteriorated during its three months in service. Decrease in output, loose diaphragms, etc., readily show up on the recorded chart. If necessary, a repair is made, a new record entered for reference, and the unit is placed back in service.

The equipment described constitutes only a few of the special devices which have been designed by the United Air Lines Communications Laboratory for servicing aircraft equipment. The development of this equipment has often been expensive; however, only by consistent servicing can radio equipment be made reliable and it is this reliability that has led to the enviable safety record which the airlines have achieved.

MAINTAINING CONTROL EQUIPMENT

(Continued from page 12)

large inrush current may burn out the coil within a few seconds.

Such mishaps can be prevented by the use of a thermal cutout to protect the coils. When the thermal cutout opens because the armature fails to close, it is merely necessary to replace a small link made of two pieces of metal held together by a low-melting-point solder.

Resistor Care

Resistors are important auxiliaries in electric control work, and are encountered in many types, such as porcelain-tube, enameled resistors, open-wound, wire resistors, strip-wound, cast-grid, etc. Some types are more likely to develop certain kinds of trouble than others.

Cast Grid Servicing

Cast grids are usually assembled and held together by being clamped on a tie rod. The current passes from one grid unit to another across a ground face. When too much current, say several hundred amperes, is made to flow across these ground surfaces, they may develop high resistance and destroy the joint.

To overcome this difficulty, these joints should be cleaned and the current path paralleled. This procedure will reduce the current in the middle joints, where the trouble usually occurs or is most likely to develop.

Edge-wound or strip resistors usually have their terminals either brazed or welded to the strip, which prevents excess resistance from developing at this joint. In order to provide an adjustable contact on this type of resistor, a clamp type of terminal is sometimes furnished. However, since the resistor may become quite hot at this point, a bad contact is very likely to develop. Therefore, if one does develop, the best cure is to braze the terminal at the proper position.

Edge-Wound Resistors

The high-resistance cast grids that have a small cross-sectional area sometimes give trouble because of breaking, especially if they are mounted on machines that vibrate severely. The best correction for this trouble is to use an edge-wound resistor, which is non-breakable. This type is made of corrosion-resisting material that is capable of withstanding very high temperatures without scaling.

The function and importance of relays is too well known to need discussion here. To cover all the relays used would be an endless task because there are many varieties of them. A number of relays have been designed to operate as a function of time. The one that was designed first to operate on a time basis was the dashpot type. Movement of a solenoid is retarded by means of a dashpot, giving a time-current relation that is called an inverse-time characteristic.

Dashpot Troubles

The kind of trouble that is inherent in a dashpot was the primary reason for the development of the other types of timing relays. A dashpot is essentially a close-fitting device that is easily affected by dirt, gumming of the oil, and corrosion of the close-fitting parts. Also the torque of the magnets varies with the position of the solenoid armature in its coil.

Tripping Problems

If trouble is experienced due to tripping while starting a motor or shortly after getting up to speed, there are three things that can be done:

1)—A heavier oil may be used if the relay almost holds.

2)—A starting contactor can be used that does not include the overload relay in the circuit. After the motor is up to speed, the running contactor can close and the starting contactor can open, connecting the overload relay into the circuit. This is a rather complicated method, but it is sometimes used.

3)—The final alternative is to replace the dashpot with a temperature type of overload relay. This is one of the reasons why the temperature-type overload relays were originally developed.

Since the function of a temperature overload relay is to protect a motor under all ambient temperatures, its final temperature should be the same as that of the motor, which is 90 C. This means that a motor can have a 50 C rise in a 40 C ambient.

Therefore, the relay should just trip if placed in a 90 C ambient, or in a pail of water held at that temperature. If a relay does not function correctly, it should be immersed in a pail of water kept at 90 C and adjusted so that it will. The adjustment should not be made by bending the thermoflex strip. If this method of checking or adjust-

ment does not provide the necessary degree of protection to the motor, it can be assumed that the size of the relay heater is not correct.

Time Delay Relays

The third type of relay, the time delay relay, is used for controlling the rate of acceleration of motors and for many other functions where a short-time-delay is needed. In this escapement type of relay, a pendulum is used as the governing means, which makes it necessary to mount the relay in a definite position with respect to the motion of the pendulum.

It is not always possible, however, to mount the relay in the proper position, and when it is in the out-of-true position it is less dependable. Shortening the pendulum makes it possible to tip the relay further from the vertical, but the shorter pendulum results in a shorter time delay.

New Relay Design

To overcome this limitation a new design that has a balanced pendulum has been made available. The variation in time is obtained by changing the length of the stroke. In principle the two devices are the same, but mechanically they are quite different.

If the old-type escapements fail to time properly, their mounting position should be checked. However, if the application is such that it is difficult to mount and keep the relay in the proper position, use of the balance type should be considered.

Temperature Overload Relay

A temperature overload relay does not need any such maintenance attention as outlined for dashpots, but its use does involve the observation of certain precautions. Since it is sensitive to temperature, it should not be put in a strong draft, such as that from a window or a circulating fan. If it is necessary to place it in such a position, it should be shielded by a cover.

Conversely, a temperature overload relay should not be located above a source of heat, such as steam pipes. In brief, the relay should be in an ambient temperature that does not differ greatly from that of the motor.

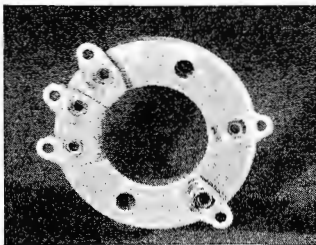
Corrosive fumes in many plants, such as those manufacturing rayon, coke,

(Continued on page 31)

ARMY— —NAVY

Tube Socket

requirements solicited



Sockets for Ultra-high frequency Acorn Tubes — Grade "G" Ceramic approved for Army, Navy and Signal Corp applications. Special Grade "C" silver Plated Contacts. Snap-in contact withstands severe vibration.



New Low Loss—"Lock-in" Sockets — Revolutionary designed contact insures dependable service for Tanks—Airlanes—Ship—etc.

Write our Engineering Department for Samples and Send in Your Specifications.

A. W. FRANKLIN MFG. CORP.
175 Varick St. New York

Sockets • Terminal Strips • Plugs
Switches • Metal Stampings

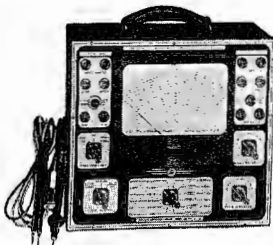
THE INDUSTRY OFFERS

(Continued from page 25)

voltage ranges at 1000 ohms per volt from 0-3 to 0-6000 volts; seven a-c ranges, 0-600 microamperes to 0-12 amperes; eight a-c output ranges to 6000 volts, and eight decibel ranges, from -26 to +70 db.

Available as an accessory item to series EV-10, there is an RF-10 vacuum tube probe which provides direct means for measurement of super-sonic r-f and u-h-f voltages.

Series EV-10 and RF-10 are described in the 1942 Precision catalog.



* * *

ERRATUM

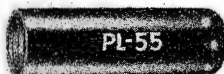
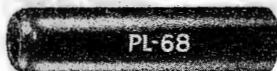
In the text describing a High Speed Limit Bridge, page 31, April COMMUNICATIONS, the correct illustration appeared on page 33, beneath the text on L-F-Linear-Time Base Generator. The illustration appearing on page 31, is that of the L-F Linear Time-Base Generator made by Allen D. DuMont Laboratories, Inc., Passaic, N. J. The High Speed Limit Bridge is made by Industrial Instruments, Inc., Jersey City, N. J.

* * *

AMERICAN MOLDED JACKS, PLUGS, AND "THROW-AWAYS"

American Molded Products Company of 1751 North Honore St., Chicago, Ill., are now producing molded plastic plugs and jacks from stock molds for immediate delivery.

A new tough plastic "throw away" is also offered by American Molded Products Company. This is the familiar screw-plug, dummy-plug, cap-plug or other device for the protection of equipment or articles from dirt, dust and moisture while being handled or in transit. The "throw-away" has no functional value after the shipment reaches its destination. It is literally thrown away. Hence the saving with efficient "throw-aways" in plastic as against critical metals is considerable.



* * *

ANTENNA SWITCHING RELAY

A new, small, light-weight antenna switching relay has been developed by Ben-

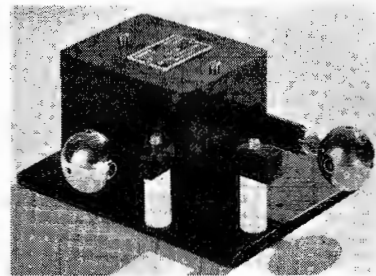
dix Aviation, Ltd., Burbank, Calif.

The unit is said to be able to handle an r-f potential of at least 20,000 volts at 30,000 feet altitude and provides instantaneous break-in for keying operations. The high vacuum prevents transfer of energy between the open contacts.

The relay consists of a single pole double throw switch enclosed in a highly evacuated glass envelope. The armature when actuated by an external electro magnet transfers the circuit from receiver to transmitter. As the space between the open contacts is approximately .015" and because of the small mass of the armature, the transfer is fast enough for instantaneous break-in. This speed enables keying at 40 words per minute.

All maintenance is eliminated due to the permanently fixed contacts being enclosed in the glass envelope.

The unit weighs 24 ounces, including case, and measures 2 5/8" x 5 5/8" x 6 7/16" overall.



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for Output TRANSFORMERS
of Highest Permeability

Standard stocks in a wide range of sizes for Audio, Choke, Output and Power Transformers. Write for dimension sheets.

permanent MAGNETS

ALNICO (Cast or Sintered)

COBALT-CHROME-TUNGSTEN

Cast, formed or stamped permanent magnets for all purposes. Engineering cooperation backed by 38 years experience in magnet making.

TOOLS • DIES • STAMPINGS
HEAT TREATING

Thomas & Skinner
Steel Products Co.

1113 E. 23rd St. Indianapolis, Ind.

NEWS BRIEFS

(Continued from page 19)

transmitter. Station W47A, Schenectady, N. Y. has joined this group. Its main G.E. transmitter is in the Helderberg Mountains, 12 miles airline from the studio. The ST G.E. equipment operates in the 330 to 342 mc band and consists of a 25-watt transmitter, a crystal control receiver and temporary directive antennas at both ends of the circuit.

* * *

GEBHARDT UNIVERSAL PRODUCTION HEAD

Godfred C. Gebhardt has been appointed production supervisor at the Inglewood, Cal., factory of the Universal Microphone Co.

* * *

R.C.P. EXPANDS

Radio City Products Co., Inc., manufacturers of the RCP line of test instruments, has moved its plant and offices to new and larger quarters at 127-133 West 26th Street, New York City.

* * *

AUDIO PRODUCTIONS, INC., SOLD

Audio Productions, Inc., a subsidiary of W. E., was recently sold to Frank K. Speidell, president, acting for himself and certain associates together with interests representing outside capital. Associated with Mr. Speidell will be Lawrence J. Fox, Jr., Joseph Cullman, Howard S. Cullman, John F. Wharton. Mr. Fox will become treasurer of Audio. Herman Roessle will be vice president, and P. J. Mooney, secretary.

Audio's new production headquarters and general offices are in the Film Center Building at 630 Ninth Ave., New York.

* * *

CHAMBERLAIN CALLED TO NAVY

A. B. Chamberlain, chief engineer of the Columbia Broadcasting System, has been called for active naval duty in Washington, D. C., as a Lieutenant Commander. He has held this reserve commission since 1935. No successor has been named yet.

* * *

OIL CIRCUIT BREAKER CATALOG

Small oil circuit breakers designed for use on a-c in industrial plants and power houses where interrupting capacities of 50,000 kva are required, are described and illustrated in a new 12-page catalog just released by the Roller-Smith Company, Bethlehem, Pennsylvania.

These circuit breakers are said to have continuous carrying capacities ranging from 600 to 3,000 amperes at voltages up to 15,000 volts. They can be mounted on switchboards, pipe frames, self-supporting steel panels or on the wall. Manually and electrically operated designs are available.

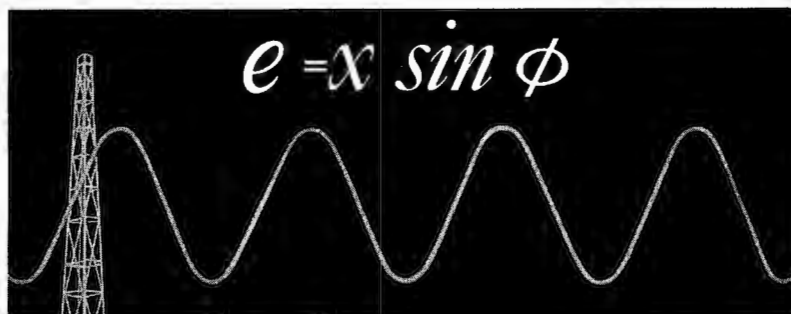
The catalog discusses various methods of tripping, describes attachments that can be supplied, gives the characteristics of each size of breaker and shows dimensions and typical control diagrams.

* * *

TWO SYLVANIA MEN DON UNIFORM

R. A. (Dick) Bachhuber and Joseph F. Anderson of Hygrade Sylvania Corporation (Radio Tube Division), have joined the army. Mr. Bachhuber has reported for active duty in the Signal Corps at the rank

(Continued on page 31)



Constant Voltage

... undistorted!

SOLA Constant Voltage Transformers are famous for low distortion . . . Now available in units that deliver an almost *Perfect Sine Wave* . . . A regulated source of Constant Voltage, free from harmonic distortion . . . A final solution to your voltage regulation problems.

SOLA ELECTRIC CO., 2525 CLYBURN AVE., CHICAGO

Ask for Bulletin ECV-74.



ital to wartime communication SOLA CONSTANT VOLTAGE TRANSFORMERS



Demands

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This photo taken in action in Bataan by U. S. Army Signal Corps

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That will, that belief, is known as *morale*.

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Give to the USO

NEWS BRIEFS

(Continued from page 29)

of First Lieutenant. Mr. Anderson is preparing himself to join the Air Cadet Corps.

* * *

CLAYTON GOES TO NAVY

John M. Clayton, advertising manager of General Radio, Cambridge, Mass., has been given a leave of absence for the duration, to enter the Naval Research Laboratory.

* * *

FEDERAL TUBE DATA

Two new bulletins describing the F-132-A and the F-212-E transmitting tubes have been released by the Federal Telegraph Company, Inc., of 200 Mt. Pleasant Avenue, Newark, N. J.

The F-132-A tube can be used as a Class A or B audio amplifier, while the F-212-E can be used as a r-f power amplifier, oscillator, a-f power amplifier or Class B modulator.

* * *

RCA INSTALLS 155 NEW SOUND SYSTEMS

A total of 155 RCA sound system installations, including many novel and unusual in design, have been completed during a recent 30-day period, according to George Ewald, RCA Commercial Sound Division Manager.

* * *

G. E. DELTABESTON AIRCRAFT WIRE CATALOG

A new 16-page catalog on Deltabeston (Continued on page 32)

CONTROL EQUIPMENT

(Continued from page 27)

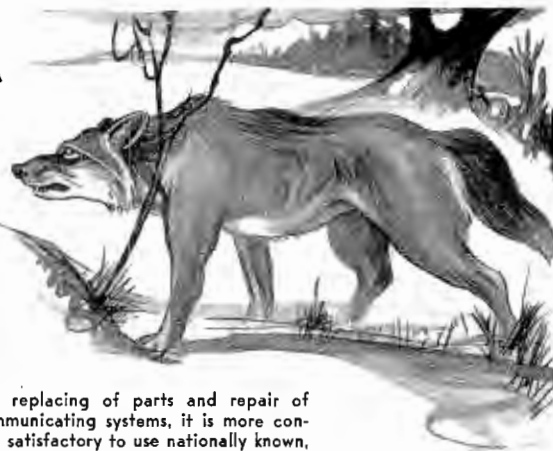
sulphuric acid, nitric acid, chlorine, and so on, rapidly attack the metal parts of control devices and render them inoperative.

To overcome this trouble all the operating parts are frequently immersed in oil in a container capable of withstanding the corrosive atmosphere. The container is made either of cast iron or of heavy boilerplate steel, which is given a protective coating of a paint that is capable of withstanding the fumes of gases encountered.

When it is impracticable to oil-immersed a given type of control, the equipment is enclosed in a heavy case with a tight, gasketed cover. The enclosing case is protected with a suitable corrosion-resisting paint.

Control equipment can be quite simple or very complex, and the job of the maintenance man is easier if he has available instruction books and wiring diagram covering every piece of control and every circuit for which he has responsibility. Extra coils and contact tips should be kept on hand as well as a complete list of spare parts. Maintenance is simplified considerably if the maintenance man makes a practice of becoming thoroughly familiar with the circuits and operation of each new controller as it is installed.

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A Lone
Wolf



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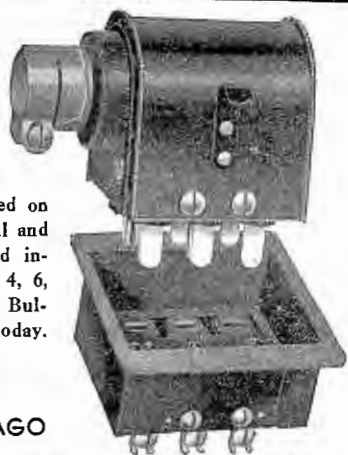
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NEWS BRIEFS

(Continued from page 31)

asbestos and synthetic-insulated aircraft wires and cables, is now available from the Deltabeston sales section of General Electric's appliance and merchandise department at Bridgeport, Conn. The wire shown in the catalog has been approved under the Army and Navy specification A-N-JC-48. The catalog illustrates, describes and lists sizes of the Deltabeston wires and cables designed especially for use in aircraft.

Outstanding features of this new wire are said to be light weight, small diameter, and higher current carrying capacity. A comparison in this catalog of Deltabeston aircraft wires test results include tensile strength elongation, accelerated aging, oil absorption, flammability, short circuit test, air oven test, bend test and flexibility test.

UNIVERSITY MOVES

As of June 1, University Laboratories will be located in larger quarters at 225 Varick Street, New York. New equipment and modernized manufacturing facilities will permit greatly increased production of the University line of horns and speakers.

PRECISION APPARATUS MOVES

The Precision Apparatus Company, formerly of 647 Kent Avenue, Brooklyn, New York, has moved to 92-27 Horace Harding Boulevard, Elmhurst, L. I., New York. The new quarters are more than three times the size previously occupied by this concern. Executive and general offices, laboratory, manufacturing and assembly facilities are now incorporated under one roof.

NEW ICA CATALOG

Engineers in the radio and communications industry will find use for the new 12 page catalog just announced by the Insuline Corp. of America, 30-30 Northern Blvd., Long Island City, New York. It illustrates and describes the entire line of ICA metal chassis, cabinets, bases, racks, panels and many other metal specialties adaptable for war production. Write on your letterhead for your copy.

MYCALEX DATA

The Mycalex Corp. of America, 7 E. 42nd Street, New York City, has prepared an interesting illustrated booklet containing

descriptions of Mycalex uses in radio, telephony, communications, railroading, aviation, X-ray and other fields. Mycalex, a patented combination of mica and electrical glass, is filling many needs today in commercial and war production. The booklet will be sent gratis to engineers and executives.

BONDED RUBBER CATALOG

The application of bonded rubber vertical snubbing mountings for vibration control and shock absorption in electronic equipment is described in a new 20-page bulletin 103 published by Lord Manufacturing Company, Erie, Pa. In addition to describing the complete line of Lord vertical snubbing mountings, this Bulletin contains basic engineering information.

WESTINGHOUSE ELECTS NEW VICE PRESIDENTS

Four Westinghouse executives have been elected to the rank of vice president. They are Andrew H. Phelps of Pittsburgh, Pa., manager of purchases and traffic; L. E. Osborne of Philadelphia, Pa., manager of the steam division; Frank C. Reed, of Jersey City, N. J., president of the Westinghouse Electric Elevator Company, a subsidiary, and Walter C. Evans of Baltimore, Md., general manager of radio, x-ray and broadcasting divisions. All the new vice presidents will continue in their present executive posts.

VWOA NEWS

(Continued from page 21)

sociation and president of the Farnsworth Television and Radio Corporation, had the honor of being one of the first to convert from the production of radio equipment to All-Out-War-Production. . . . V. P. Villandre, chairman of our ticket committee, did a grand job at the recent cruise, and also lent great assistance in establishing the facts on several recent disasters in which the radio officers distinguished themselves.

Under the tutelage of E. H. Rietzke, president of the Capitol Radio Engineering Institute, our scholarship student, "Dick" Nebel is receiving a comprehensive training in Practical Radio Engineering. Upon graduation, or for that matter now, "Dick"—a competent radioman despite his handicap of paralysis of both legs since the age of three—is available for special service which does not entail his leaving home.

A nice letter came in from Major General Follett Bradley, Commanding General First Air Force at Mitchell Field, N. Y. General Bradley was the wireless operator and observer aboard the plane on which General Arnold, Chief of the Air Forces of the United States, was the pilot on that historic occasion, when radio was first used in an airplane for communicating observations of artillery fire in 1912. General Mauborgne, former Chief Signal Officer of the Army, designed and installed the equipment.

IN a recent broadcast under VWOA sponsorship, Colonel Sadtler, representing the Chief Signal Officer of the Army, Major General Dawson Olmstead, said:

"I know that every radio operator will want to serve his country to the utmost of his ability whether it be in the military service or in the civilian defense.

"I urge you to join NOW!"

NEW CBS SYSTEM

(Continued from page 13)

and three are reversible between Europe on one side and Mexico and Central America on the other. These directional antennas consist of stacked horizontal broadside arrays with parasitically excited reflectors.

The third r-f assembly is normally pre-tuned, connected to a third antenna array and held in readiness for instant service in connection with the instantaneous frequency change feature of this equipment.

This installation is the only one in which tuning of the higher power stages is continuously variable for the complete change from 6 to 22 mc from the front panel of the equipment. A motor-driven "dolly" arrangement operating on a worm drive beneath each power amplifier enables the attendant to tune any of the three amplifiers to the proper frequency in any of six international bands automatically.

The r-f generators, modulating units, and power amplifiers are completely interchangeable. Any of the power amplifiers can be connected with any of the 13 antenna systems by the turn of a wheel. In view of the simplicity of this method and the other operational methods, among which are the setting up of the r-f channel in advance, many advantages are apparent. For, for instance, by the simple turning of two switches on the control panel, a program may be switched instantly to another frequency and to another antenna, re-directing it to another part of the world. In some systems, many "off-the-air" periods are necessary during this frequency-shift period.

Inductive coupling is used between the output of the circuit and the final stage and the line to the antenna switching system. Mechanically this consists of a transmission-line or frame mounted in a horizontal plane directly above and running the full length of the tank cir-

cuit frame. This coupling loop is electrically grounded directly at its center. Variation of coupling is accomplished by mechanically varying the horizontal distance between the two conductors forming this loop.

To tune the tank frame to a particular frequency, its length is varied by means of a short circuiting bar. Its position may be continuously varied along the full length of the tank frame.


In the antenna switching system, the switches are mechanically interlocked in vertical sequence, and electrically interlocked in a horizontal sequence.

In the array, the reflectors are used to obtain an additional gain, in this instance, of almost 3 db, in the desired direction of radiation. This result is equal to doubling the carrier power of the transmitter, with the additional advantage of reducing backward radiation. On the higher frequencies this is important, for oftentimes quality of reception is impaired due to echo effect.

Three direct circuits carry the programs from New York. However, in the event of a breakdown of these circuits, a fourth or emergency circuit utilizing f-m relay transmitters located on the roof of a New York City skyscraper, can be placed into operation. This transmitter feeds signals to a unidirectional antenna, which in turn beams to similar type receiving antenna on the transmitting area plot.

In addition to shortwave broadcasting, the new facilities will be capable of transmitting direct from New York to Mexico City, Buenos Aires, Rio de Janeiro, Santiago, Bogota, Lima, Havana and other distant points.

The new 50 kw transmitters and associated equipment were designed and manufactured by the Federal Telegraph Company, while the antenna systems were designed and erected by the Mackay Radio and Telegraph Company. CBS engineers drew up the specifications for the transmitters and allied equipment.—DONALD PHILLIPS.



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NAB CONVENTION

(Continued from page 16)

come even more predominant in this emergency.

In making up the inventory of parts, a tremendous amount of work could be avoided, if only those parts creating bottlenecks in production were included, said E. K. Cohan, technical director for CBS, who was present at the discussion. He pointed out that there were six basic parts that could be used as a basis, and that as a result of such simplified inventory, any other necessary parts would be generally available. To aid in supplying parts that are now difficult to obtain, the services of jobbers handling amateur parts could be employed, said Jack Berman of Shure Brothers, Chicago. Many of these jobbers also have for sale ham outfits left by those now in the services. These have parts that could be used in commercial broadcasting, he pointed out. In addition, such distributors could act as a clearing house. This particular topic will be discussed at the forthcoming meeting of the parts distributors on June 8 in Chicago, prior to the regular RMA one-day convention.



Left to right, Neville Miller, president of the NAB; Arthur Van Dyck, president of the IRE, and Lewis Winner discussing the suggested pooling plan at the technical session.

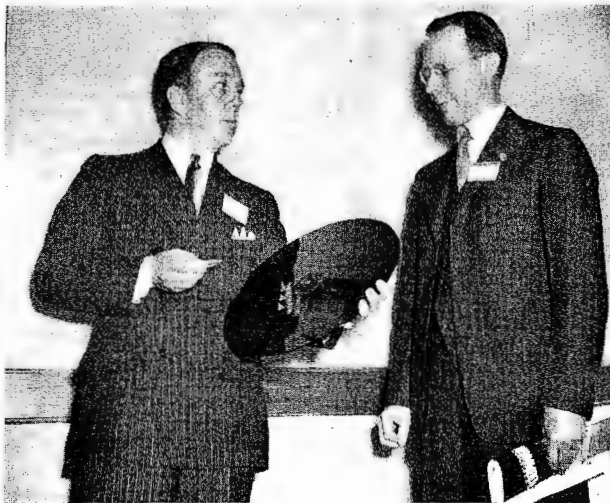
Rebuilding and reactivating of tubes received intense consideration at this session with accent on the reactivation process, that was outlined by Charles Singer of WOR recently. Portable re-

activators that might visit stations with tube trouble were suggested. Rebuilding of tubes was found to be a delicate business in which few were skilled, and thus received but little attention.

During the convention there were rumors that the equipment used by the smaller stations would be turned over to the larger stations to help keep them going. This story was described as a malicious lie. The equipment used by the smaller unit has but little value in the larger station and in addition the smaller stations are considered just as essential in their respective posts. A reduction of time on air may be introduced to conserve equipment, but even this is quite remote, according to the general consensus.

An effort will be made to secure a relaxation of the percentage modulation rulings so as to permit a reduction of filament voltage and consequent increase in tube life. This was another major issue revealed at the recent Ohio State Broadcast Conference, during the

(Continued on page 35)



Ralph Powell of Presto Recording (left) explaining the characteristics of a new glass base disc to W. R. David of G. E. at the Presto NAB exhibit.

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FREQUENCY STANDARD

(Continued from page 9)

ment purposes. The three standard frequency outputs provide complete coverage in the audio-frequency band; the addition of mixing circuits, if desired, permits the superposition of the 100 cycle harmonics and the 1,000 cycle harmonics, thereby giving the combined check points through the audio band. These circuits were not included in the frequency standard.

After the usual preliminary adjustments of the circuits to obtain correct driving voltages throughout, and adjustments to place the fork accurately on 100 cycles per second, the stable deviation (average) of the standard frequency was found to be of the order of 10 parts in one million, which was satisfactory for the purpose at hand. The variations in frequency of this order of magnitude existing were primarily attributable to sudden power-line variations not completely stabilized by the voltage regulators, although these hold the average line voltage well within 1 percent. This is readily understandable, when it is considered that a sudden power line surge lasting well under one second may introduce an error of one part in 86,400 if the surge is sufficiently large to affect the synchronous clock. This is an error of the same order of magnitude as the accuracy desired in the measurement. Thus it is evident that for accuracies of a higher order, storage batteries must be used as a supply source, if complete reliability is to be placed in the average frequency indicated by the synchronous clock reading, in spite of the fact that the tuning fork oscillator is exactly on frequency.

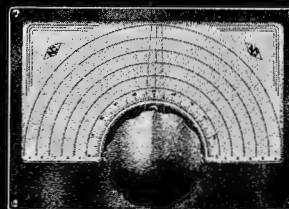
NAB CONVENTION

(Continued from page 34)

talk by Charles Singer.

The grim topic of sabotage, fire and theft, discussed by J. D'Agostino of the National Broadcasting Company, revealed over a dozen counter measures to be taken by broadcasting stations in this effort, counter measures which many stations have already taken and which many are completing now. These measures included the barring of all doors that should be of solid material rather than of glass. Where glass now prevails, suitable netting or other protective measures such as jarproof liquid sprays might be used. Other measures included fences, guard assignments, guarding of circuits—telephone and line, and erection of suitable floodlighting. The floodlighting measure may have to be altered where dim-outs are necessary.

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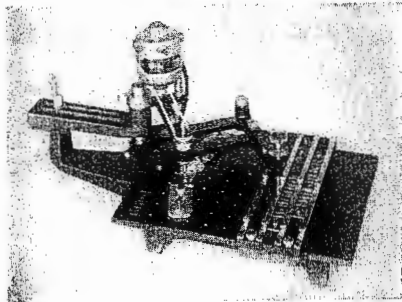
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- **SMALL SIZE**—VARIACS are much smaller than any other voltage control of equal power rating.
- **LINEAR OUTPUT VOLTAGE**—Output voltages are continuously adjustable from zero by means of a 320 degree rotation of the control knob.
- **CALIBRATED DIALS**—VARIACS are supplied with reversible dials which read directly in output voltage from zero to line voltage or from zero to 15% above line.
- **SMALL TEMPERATURE RISE**—Less than 50 degrees C. for continuous duty.
- **ADVANCED MECHANICAL DESIGN**—Rugged construction—no delicate parts or wires.

VARIACS are stocked in fifteen models with power ratings from 170 watts to 7 kw; prices range between \$10.00 and \$100.00.

Because practically all of our manufacturing facilities are devoted to war projects, to secure delivery of any of these products within a reasonable time a preference rating certificate or other approved priority rating will be necessary.

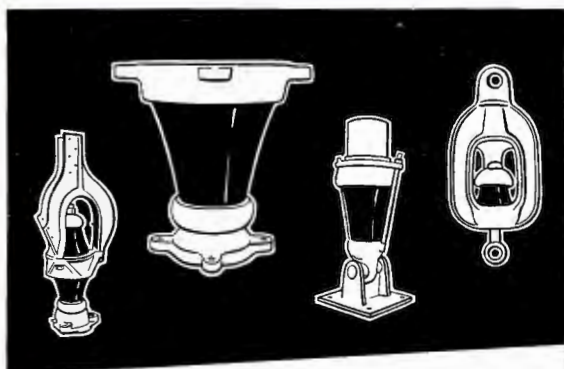
* Trade name VARIAC is registered at U. S. Patent Office. VARIACS are patented under U. S. Patent 2,009,013 issued to General Radio Company.

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GENERAL RADIO COMPANY

CAMBRIDGE, MASSACHUSETTS

Branches in New York and Los Angeles



The largest and smallest. Lapp curved-side cones—for a low power pipe mast, and for the world's largest vertical radiator—1050 feet.

LAPP HAS MADE 142 DESIGNS

**IN ANTENNA
STRUCTURE INSULATORS**

**.. ALL ARE BASED ON THE
LAPP *CURVED-SIDE*
COMPRESSION CONE**



Each of the 142 Lapp units—for self-supporting towers, guyed masts and mast guys—is designed around the Lapp curved-side compression cone of electrical porcelain. More than 20 years of service records prove that this Lapp design meets every operating requirement. It affords double the strength of an ordinary straight-side cone, assuring the maximum in security and permanence. Finally, each insulator, before shipment, is tested by loading to 50% more than maximum design load. Most radio engineers know they've covered the insulator question adequately when they say to their tower manufacturer, "Use Lapp Insulators." Lapp Insulator Co., Inc., LeRoy, N. Y.

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